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THE PROJECTED NEW BARGE CANAL OF THE STATE OF NEW YORK.

(MAP, p. 320.)

BY

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In the years following the Revolutionary War the subject of navigable canals was a very absorbing one to our forefathers. In this new and rapidly-developing country in those pre-railroad days the importance of canals in the transportation world can hardly be appreciated at the present time. Canals were projected all over the country, and many were built. The attention and labours of the ablest men of the period were devoted to canal schemes, their financing, locating, and building.

A good many of the canals that were built have succumbed to new conditions and been discontinued, being unable to stand the competition of railroads. Some, however, have stood the test of time, and have remained important factors in the commercial world to the present day. Without question the most important of these early artificial waterways was the Erie Canal through the State of New York, connecting the Hudson River with Lake Erie. This canal, although originally built of small size, played a very important part in the settlement of the great West, or what was then the great West, by furnishing a route in connection with the Great Lakes by which the products of the new Western country could reach the markets along the seaboard, and by which in turn it could get its supplies of clothing, tools, groceries, &c., at an economical rate for transportation. It is certain that the settlement and development of the New York and New England Hinterland were enormously expedited by the Erie Canal.

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Locally in New York State the effect of this canal was shown by the increasing commercial importance of New York City and the establishment and development along the line of the canal of the most important chain of cities in the country—Albany, Troy, Cohoes, Schenectady, Little Falls, Utica, Rome, Syracuse, Rochester, Lockport, and Buffalo.

Some of the early New York canals have been abandoned. Those which are left and kept in a navigable condition are: the Erie Canal, connecting the upper chain of Great Lakes above Niagara Falls with the Hudson River, and thence with the seaboard; the Oswego Canal, which connects Lake Ontario with the Erie Canal; and the Champlain Canal, which connects Lake Champlain with the navigable water of the Hudson. The Erie Canal, which is the principal member of this canal trinity, is 350 miles long, and at present has 72 locks. It was originally built with a depth of four feet, with locks 90 x 15 feet, being of a size to accommodate boats of but 80 tons capacity, and was completed in 1825. Tolls on the canal were high at first, but were gradually reduced, and for many years have been abolished altogether.

It is a noteworthy fact that before they were finally abolished the tolls had more than paid for the canals of the State and their enlargement.

The small 80-ton canal was soon found inadequate, and it was enlarged to its present capacity—that is, for boats carrying 240 tons of freight. This work of enlargement was started in 1835, but was not completed until 1862.

When the canal was built, and when it was enlarged, the only known or successfully-developed method of canal-boat propulsion was by animal towing, and a tow-path was provided all along the canals. The necessity for this tow-path was one of the principal factors which caused the canal to be kept out of water courses and built in the upper portions of valleys. The development of steam canal-boat propulsion has changed the problem, and the great canal that New York is to build will now be located, wherever possible, in streams and lakes, and it will have no tow-path. This will reduce the cost of maintenance enormously, for the cost of keeping the tow-path in order is the heaviest item of expense of the present canal.

The New York canals were no sooner enlarged to their present size than agitation for their further improvement commenced. This culminated, about ten years ago, in the adoption of a project for deepening the canals so that they would accommodate boats of

eight feet draft instead of six feet, and for lengthening the locks so that they would take two boats of the same length and width as at present, coupled tandem, at one lockage. The State made an appropriation of $9,000,000 to carry this project into effect. It was soon found, however, that the amount named was grossly inadequate, and that to complete the project would cost two to three times the sum which had been voted. The work was also badly managed, and the people of the State were indignant at the deception which had been practiced on them regarding the estimates and the scandals attending the work, and the project was abandoned. Then came another period of agitation, investigation, and discussion. All sorts of things were proposed. Many prominent people wanted a ship canal connecting the Great Lakes with the sea, and several routes were surveyed, and estimates of cost of various-sized canals made. Many wanted the $9,000,000 project completed, either as originally proposed or with modifications. Some wanted to turn the State canals over to the General Government, and depend on it for maintenance and improvement. Some wanted to abandon the canals altogether, and some to utilize the canal right of way for State railroads.

In 1897 the writer of this paper, in a report to the General Government, proposed, as the best solution of the problem, that the canals should be enlarged to enable them to be used by barges carrying 1,000 to 1,500 tons. Governor (now President) Roosevelt, appointed a Board of prominent New York business men soon after this to advise the State what to do with its canals, and this Board, after more than a year of investigation, and the careful consideration of everything that could be proposed, reported in favour of enlarging the Erie Canal to a capacity for barges of 1,000 tons, and a lesser improvement for the Oswego and Champlain Canals. The Legislature caused surveys, plans, and estimates for the work to be made. All the canal people of the State finally came in under the banner of the 1,000-ton barge canal, and through their united efforts the Legislature at last passed a bill for the enlargement of the Erie, Oswego, and Champlain Canals, to enable them to be used by 1,000-ton barges, with all the locks of sufficient size to take two boats, coupled tandem, at one lockage.

The estimated cost of the work proposed was $101,000,000. At the fall election of 1902 this proposition was submitted to the people of the State, who approved it by a majority of about 250,000 votes.

New York is thus committed to and has entered upon this

tremendous work of canal improvement—by far the greatest work ever undertaken by any State.

This projected work is in the very front rank of canal propositions. It is overshadowed in the public mind by the Panama Canal, on account of the international character and the interesting complications that have attended the inauguration of that work by the United States. In commercial importance the Erie is in many ways the equal of the Panama Canal. On the Panama it is hoped to some time reach a tonnage of 10,000,000; on the Erie all works, structures, water supply, &c., are predicated on a tonnage of 10,000,000, and provisions are made for accommodating, at slight additional expense, a tonnage greatly in excess of this. On the upper Great Lakes there is a water-borne commerce of very nearly 90,000,000 tons per year. The Erie Canal will furnish the cheapest route for connecting this vast lake commerce with the seaboard, and its wide-reaching influence can hardly be conceived or appreciated except by those who have given years of study to the problem.

In magnitude the work that New York has undertaken exceeds the work at Panama. More earth and rock must be excavated, more masonry used, and more dams built. The cost per unit is not nearly so high as at Panama, because the work will be done in the temperate zone, where labour, tools, and materials are abundant and reasonably cheap.

In the complexity of the engineering questions involved the Erie is hardly second to the Panama Canal; for, while the canalization of the Mohawk River is a very different problem from the control and utilization of the Chagres River, they are both engineering projects of the very first magnitude.

The building of the Panama Canal under conditions akin to the proposed enlargement of the Erie Barge Canal would be a simpler, cheaper, and easier work than that which New York has undertaken.

The Projected Barge Canals.

The barge canals that New York is to build will follow the same general route, fulfill the same functions, and minister to the same wants as the present navigable canals connecting Lakes Erie, Ontario, and Champlain with the navigable waters of the Hudson below Troy.

In three important respects they will differ from the existing canals: first, as to size and capacity; second, as to location; and third, as to the character of navigation provided for.

Size.

The locks of the new canals which govern the dimensions of the boats that can be used are 28 feet wide, 310 feet long, and 11 feet deep. The canal prism has a depth of 12 feet and a general minimum width on the bottom of 75 feet in canal sections and 200 feet in rivers, pools, and lakes. Boats can be built which will pass through the canal carrying 1,000 tons of freight, but it will probably be found advantageous to sacrifice some of the carrying capacity to secure better models and greater clearance. The lift of the locks will be much greater than at present, and the number of locks will be greatly reduced. On the present Erie Canal there are 72 locks; on the new Erie Barge Canal there will be but 38 locks.

The new locks will take two canal boats, each of 150 feet length, coupled tandem, at one lockage; and this makes the lock capacity 2,000 tons, or about eight times that of the present canal. As freight boats nearly always travel in pairs coupled tandem, the advantage of the double-length locks in doing away with the necessity of uncoupling and recoupling at every lock is very great, saving much time and lessening dangers.

Location.

A very decided change is made in the location of the canals. The Erie Canal is about 350 miles long, and the new canal follows the old canal for only about 100 miles; the other 250 miles is almost entirely by a new route. Large portions of the Champlain and Oswego Canals also follow new locations.

The existing canals may be called "hill-side" canals, as they go through the open country and along the upper portions of valleys above the rivers, from which they religiously keep away to the greatest extent possible. The new and greater canal is put in the valley bottoms and in the water-courses and lakes wherever practicable.

The principal advantage of the valley bottom location in the case of the greater canal are cheapness of construction, greater freedom and ease of movement by boats in the wider waters of the water-courses and lakes, greater rapidity and less cost of transportation, greater immunity from accidents that disable the canal, and less cost of maintenance. With the small canal as originally built and as subsequently enlarged to its present size it would not have been economical, with the knowledge and means then possessed, to have built the dams and locks required to canalize the Mohawk and other rivers and to excavate the large channels

required for flood-discharge. With the large barge canals now proposed this canalization is not only desirable but is cheaper than it would be to utilize the existing lines of the canals.

Navigation.

The present existing canal is a "tow-path" canal, built with the distinct idea that all business on it should be done by animal towing.

In the new and larger canal no tow-path is provided, and it is expected that navigation through it will be by means of steamboats properly adapted to it and towing other motorless cargo boats, in accordance with the custom which has been developed and is now in vogue on the Erie Canal, to a certain extent. It is this change in the method of navigation which permits the valley bottom, lake, and water-course location to be adopted.

Long years before the construction of the Erie Canal the early pioneers had found a watery highway extending nearly across the State of New York, and it was largely used by those who settled the western portion of the State. It was not perfect, involving, as it did, many portages about falls and rapids and from one river to another, and the stemming of swift river currents, with bars and shoals, but it fulfilled a most useful function.

The Erie Canal when built did not follow this pioneer route for reasons stated; but it is a remarkable circumstance that now, after nearly a century of disuse, this old pioneer route is to be again adopted and the new and larger barge canal is to follow it without material deviation. This old pioneer route followed up the Mohawk River, with portages about the falls and bad rapids to the vicinity of Rome; thence a portage was made across to the waters of Wood Creek; thence it followed down the waters of this small stream to Oneida Lake. On across the lake it went and down the Oneida River to the junction of the Oneida, Oswego, and Seneca Rivers at Three River Point—a famous locality in the olden days. Here two routes were open to the enterprising traveller. If he were going to the settled western part of the State he would follow up the Seneca River and thence into the various branches and into the beautiful "finger" lakes tributary to the Seneca. At that time and by that route the cost of transportation between Albany and Seneca Lake was from $75 to $100 per ton, and it took four weeks to make the round trip. If he were going farther west, or into Canada, or had much freight to transport, he would ofttimes

go on down the Oswego River to Lake Ontario and thence by lake to his destination.

The projected route of the Erie Barge Canal follows up the Hudson River to Waterford. Thence, by means of the requisite locks, it reaches the Mohawk River above Cohoes Falls. From Cohoes Falls to just west of Rome the river is canalized—that is, dams are built, forming great pools, and these pools are connected by channels not less than 200 feet in width and 12 feet in depth. Above Rome there is a summit level leading over to Wood Creek, and, as in the olden days, the canal route follows down this stream and through Oneida Lake and Oneida River to Three River Point, thence up the Seneca River properly canalized to the vicinity of Clyde. From Clyde westward there are no water-courses of importance running in the right direction, and the new canal will follow generally the route of the existing canal to the Niagara River at Tonawanda. Thence the Niagara River will be used up to Lake Erie and Buffalo. Between Clyde and Tonawanda there is one important modification of the route, and this is at Rochester. The present canal goes through the city in a very awkward manner, crossing the Genesee River in a masonry aqueduct, and the route is impracticable for the large canal. Here a new route is adopted, passing to the south of the city and crossing the Genesee River in a pool formed by damming the river.

The Oswego Barge Canal leaves the Erie Canal at Three River Point and keeps on down in canalized Oswego River to Lake Ontario.

The new Champlain Canal keeps in the Hudson River from Waterford to Fort Edward, instead of following along on the bank of the river as at present. In doing this, advantage is taken of the commercial power dams which already exist in the river, and which, in connection with locks to pass them and the deepening of the river between the pools, will fully canalize the river. From Fort Edward to Whitehall, at the foot of Lake Champlain, the new canal follows the location of the existing one.

Water Supply.

The most important question connected with any canal proposition is that of water supply, and the Erie Canal is no exception. The western end of the canal will be fed from Lake Erie, as at present, the existing canal from Lake Erie to Tonawanda being retained as a water-feeder only. This, with natural local supplies from streams along the line, will give all the water required until

the Seneca River is reached, which has an abundance of water. The only locality where the water-supply problem attains great importance is at the summit level, between the Mohawk River and Oneida Lake. This is provided for, for the larger canal, by utilizing the existing sources of supply and developing additional ones by water storage in West Canada Creek, the Mohawk River, and Oriskany Creek.

If in the future more water is needed, due to increased use of the canal, or for any other reason, this can be supplied by additional storage in the Adirondacks at a comparatively small expense.

It is believed that these new and enlarged canals will be of benefit to New York in enabling her to retain and increase her commercial supremacy, largely through their controlling influence on freight rates and the prevention of differential discrimination against the port of New York, which is now and has for years been the rule.

They will also benefit the entire region of the Great Lakes, and this benefit will extend far into the interior of the Great Northwest and influence transportation rates throughout the country.

Upon the Great Lakes many millions of tons of freight are transported every year at exceedingly low rates—far lower than are possible by any other than water transportation. The canals that New York has undertaken to build will practically extend this cheap system of water transportation to the seaport of New York and other ports in the vicinity, and bind the East and West closer together.

THE NEW STIELER'S HANDATLAS.*

Gotha was the undisputed centre of geographic science for a considerable period of the 19th century, beginning with the year 1854, when August Petermann became connected with the firm of Justus Perthes. Thus the new issue of Stieler's Handatlas, which approaches completion, may be regarded as a jubilee celebration. This idea leads Dr. Hermann Wagner, in the January number of Petermanns Mitteilungen, to discuss the history of that atlas and, incidentally, to sketch the development of cartography, as applied to atlas-making, during the 19th century.

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* An Abstract of Dr. H. Wagner's paper in Petermanns Mitteilungen, Band 50, Heft 1.

Stieler's atlas first appeared in 1816, and is thus 88 years old. Atlases are generally long-lived, owing to the great investment of capital which they involve. The plates are handed down from father to son and grandson, giving rise to veritable dynasties of geographic editors and publishers. Stieler's atlas was surpassed by many of its predecessors in size and in rapidity of publication. Among them may be mentioned Ortelius' "Theatrum orbis terrarum" (since 1570), Mercator's Atlas (since 1595), which soon thereafter was vastly enlarged by Hondius sen. and jun. and Joh. Janssonius (1651, in 6 volumes, with 450 maps), the giant collections of Willem and Joan Blaeu (1631–1673), those of the Sansons in France (since 1648 ?), the atlases of Delisle, afterward published by his son-in-law Buache, and Homann's atlases (since 1707), which were the standard in Germany in the 18th century. But these cannot compare to Stieler either in length of life or in organic development. They consisted mostly of republications of earlier maps, while the various editions of Stieler represent not only the latest record of data but also the latest achievements in cartography. Dr. Wagner is thus led to discuss the requirements which a modern atlas must satisfy.

The oldest edition of Stieler looks primitive enough nowadays, yet it contained the leading features to which its popularity has ever since been due—handy size, the greatest practicable uniformity in projections, uniformity or simple proportions of scale, systematic lettering, avoidance of overloading, etc.

The temptation to increase the size of map sheets is great, because the number of sheets is thus lessened, the number of scales reduced, and duplication in marginal work largely avoided. However, the convenience in handling proves in the long run a greater advantage. The good judgment shown by Stieler in selecting the size of 35 by 29 cm., and by his successors in increasing it to no more than 41 by 35 cm., has been demonstrated by experience. The average buyer looks for an atlas which he can put on an ordinary library shelf, lift with one hand, lay flat on the ordinary writing desk, and inspect without either rising or craning his neck. Out of 100 sheets only 10 lie crosswise—an important consideration to the user.

The problem of scales is a knotty one for the editor of an atlas. Having a given number of areas of different sizes to represent, he naturally wishes to fit them, with the least possible waste of space, into his map sheets, which are all of the same size. This would involve the use of as many scales as there are maps. The user, on

the other hand, would prefer to have all the maps on the same scale, since this would enable him at a glance to estimate any distance or area. A compromise between these two requirements is found in using as few scales as possible and in making the larger scales simple multiples of the smaller. Adolf Stieler attempted this as early as 1816. His normal scale was 1 Paris foot to 160 geographic miles, or about 1:3⅜ million; for the special sheets of European states he chose the double of that scale—for Europe one-fifth, for the other continents one-tenth, etc. This still leaves large areas which cannot be made to fit into such simple proportions, and this fact increases the number of scales greatly beyond that of the great majority of the maps. While in recent times the tendency has been to choose round numbers, such as 1:1,500,000, 1:2,000,000, 1:3,000,000, the old scale of 1:3⅜ million has been retained for 20 maps of the new Stieler, because it enabled large countries like Russia and the United States to be shown on the same scale. The selection of 1:7,500,000 for the special maps of countries outside of Europe, in the new Stieler, is regarded by Dr. Wagner as one of its greatest merits, since it enables no less than 25 maps to be drawn on the same scale. The original number of some 20 different scales for 83 maps (1842) has in the latest edition of Stieler been reduced to 14. Dr. Wagner adds a word of caution against the tendency to represent certain areas in sectional sheets, susceptible of being joined into a single sheet. While for certain objects this method has manifest advantages, it is apt to shock the reader who expects each map to represent a complete, geographic unit, framed, as it were, in a fringe of adjoining countries. In high latitudes, moreover, it causes the central meridian to run obliquely across the sheet, to the perpetual irritation of cartographic nerves.

As regards projections, Lambert's azimuthal projection meets with special recommendation from Dr. Wagner, as more true to nature than the Bonne or the Sanson–Flamsteed projections. In this respect the new Stieler is surpassed by some of the more recent atlases. However, the Lambert projection is to be used for Africa, and will, no doubt, be increasingly used in future editions.

The original plan to limit the number of sheets to 50 had soon to be given up. Before Stieler's death, in 1836, the number had been increased to 75. The latest number, 100, is probably the limit of convenience in handling.

Im mapping this or that area, in greater or less detail, each atlas has, of course, to consult the requirements of the public, for which it is mainly intended. Stieler's atlas, being intended for the

public of central Europe, offers instructive evidence of the widening sphere of interests of that public, as appears from the following table:

EDITION OF	GENERAL.	CENTRAL EUROPE.	REST OF EUROPE.	OUTSIDE OF EUROPE.
1822 (50 maps).....	10	17	13	10
1840 (83 ").....	11	17	30	25
1868 (84 ").....	9	15	31	29
1902 (100 ").....	4	13	35	48

An excellent practice, adopted by Stieler in the beginning, and continued with but a brief interruption, was that of indicating on each map the name of the cartographer, and in many cases also that of the engraver. Adolf Stieler produced more than half the original maps. Those outside of Europe were mostly drawn by C. G. Reichard. A few were furnished by O. Hubbe. F. von Stulpnagel began to contribute in 1824, and after Stieler's death the work fell more and more to his share, so that in the edition of 1860 he furnished not less than 53 out of the 83 maps. In the early days some of the dozen engravers lived elsewhere—in Berlin, Weimar, etc., so that complete uniformity was out of the question. The representation of the configuration suffered especially; but yet the clearness and legibility of the maps attracted the layman, while the care and accuracy with which the data were used won the praise of experts.

The fifth decade of its existence marked the period when the atlas became the pioneer in cartographic achievement. It is associated with the names Hermann Berghaus, Carl Vogel, and especially August Petermann. Berghaus' merit lay in the care which he devoted to the configuration; Vogel's, in the uniform treatment of topographic material. Petermann developed a new school of engravers. He reformed the lettering, and introduced the stencil method of colouring. The work of such engravers as Jungmann, Hase, Stichart, and W. Weiler, about 1860, constitutes a revolution in the representation of topographic forms. After 1861 begins the work of such cartographers as E. Debes, A. Welcker, L. Friederichsen, H. Habenicht, Br. Hassenstein, Fr. Hanemann, and O. Koffmahn. Petermann's own cartographic work was mostly confined to countries outside of Europe, as might be expected of the chronicler of the great discoveries of that time. The topographic material of European states was mostly worked up by Carl

Vogel, whose unexcelled sheets have been very justly included in the latest edition. It was the great merit of the Perthes firm that it allowed every original mind to develop itself in its own way, to spend ample time on its work, and to make the most extensive corrections, when necessary. In this way Stieler's atlas in the seventies attained an undisputed position as the master work of the cartographic art.

After 1880 cartography, till then mainly centred in Gotha, became decentralized. Richard Andree's Allgemeiner Handatlas appeared in 1881, and, owing to its unprecedentedly low price, satisfied a widespread demand. It represented the most extensive attempt at colour printing up to date. The firm of Velhagen & Klasing published its atlas, which, under Scobel's direction, grew to such proportions as to represent at this day the most extensive cartographic volume in Germany. In 1895 followed Debes' "Neuer Handatlas" in excellent lithography and neatest colour print. Spamer's Handatlas brought French map work in German dress.

Petermann having died in 1878, Stieler's atlas was for some time published in the old style, but a remodelling became imperative if it was to maintain its lead in cartography. Resisting the increasing tendency to use lithography, or other processes of reproduction, the publishers decided to adhere to copper engraving, but to bring it up to the perfection of modern cartography in colour printing. The 52 maps thus far published bring Dr. Wagner to the conclusion that the atlas has once more gained the lead in its class of publications.

In its present dress the atlas represents the ever-increasing tendency toward specialization. Until not very long ago there was only one kind of atlas, just as geology included palæontology, mineralogy, and petrography. Now we have school atlases, physical, political, ethnologic, geologic atlases. Among these the "Handatlas" occupies, approximately, the same position that the "general practitioner" does among medical specialists. The various branches of mapmaking have become so extensive that no single publication can embody them. The general atlas assumes the co-existence of special atlases. It thus dispenses more and more with detailed representations of physical geography, geology, anthropology, etc. Thus Stieler's atlas has what may be called companion publications in Berghaus' Physical Atlas and in Vogel's map of the German Empire, in 27 sheets, on the scale of 1:500,000. The existence of these necessarily restricts the space devoted to those subjects in Stieler itself.

The exclusive use of the Greenwich meridian and of the metre for altitudes and depths in the new edition bears witness to the increasing unification of standards the world over.

Dr. Wagner expresses his regret that altitudes have not been indicated more extensively. As pointed out by Petermann in 1861, when he first introduced their use, altitude is as necessary to the true representation of geographic position as its companion elements latitude and longitude, and should be indicated with the same degree of accuracy, when possible. Hence, not only summits, but also valleys and plains, should bear altitude indications, since altitude is almost meaningless except by comparison with a datum point near by.

The artistic appearance of the published sheets is a triumph of copper engraving. The clearness, variety, and delicacy of the representation of ground-forms exhibit a degree of truthfulness and afford an esthetic enjoyment such as was unattainable with the black prints of former days, and has not been equalled by the best products of lithography. S.

ABORIGINAL POTTERY OF THE EASTERN UNITED STATES.

(*W. H. Holmes, in the 20th Annual Report of the Bureau of Ethnology. Pages 1-237, 177 plates and 79 figures.*)

This is an archæological study. But before discussing the work itself it may be well to look into the status of archæological research within the United States. Owing to the fact that the area east of the Mississippi River has been thickly populated for many years, and to a widespread and laudable interest in the subject, specimens have accumulated to such a degree that there is sufficient accessible material for a general survey of the whole area. The region west of the Mississippi lowlands, north of Texas, and east of the Rocky Mountains is scarcely represented in our collection. The recent settlement of this area and the sparse population may be the cause, but whether there are archæological remains or not no one really knows. West of the Rocky Mountains and in the Southwest exploration is constantly fruitful, but is far behind the Eastern area. Consequently, a résumé of the results attained in the best-known area will be timely and stimulating. To such a résumé the present study of ceramic specimens is an important contribution.

The method of the author is to take up specimens of pottery

from contiguous localities and place them in large groups, according to their objective resemblance, ultimately determining the geographical distribution of the ceramic type.

According to the introductory statement and the accompanying map there are five well-defined ceramic areas: (*a*) The Middle Mississippi Valley, approximately a triangular area defined by the mouth of the Sabine River, La., Bloomington, Ill., and Cincinnati, O.; (*b*) the southwest, southern Wisconsin, northern Illinois, straggling around Lake Michigan and across into Ohio; (*c*) the south Appalachian, between the coast and a line drawn from Mobile, Ala., to Asheville, N. C.; (*d*) the Middle and North Atlantic slope from Cape Fear to Nova Scotia; (*e*) the Iroquois, the basin of the St. Lawrence and the Lakes from Cleveland, O., to Montreal. The location of each recorded find of specimens is indicated by a dot upon the map. Thus the number of dots within the respective areas represents the relative distribution of remains, from which it appears that the great ceramic zone is the Atlantic slope and its extension to Mobile. The most barren is the Iroquoian. Between the Mississippi Valley area and the eastern area is a barren strip through eastern Ohio, West Virginia, thence direct to New Orleans. These points are not considered by the author. That the plotted distribution is affected by unequal zeal in exploration is obvious, but this can scarcely account for the whole difference. Unfortunately, the author's discussion of the relative distribution is meagre and unsatisfactory. His chief theme is the characterization of the specimens found in the respective areas. He carefully refrains from any attempts in the way of summaries and general conclusions, but the following are the chief points: The pottery of the Middle Mississippi Valley is of clay, tempered with shell and sand; the walls are thin, and the firing is well done. There is great variety of form, the great number of bottle-shaped and head-shaped vessels serving to characterize this area. The decorations are incised, chiefly curved designs, with extensive use of colour. With the possible exception of the Southwest, this is the area of the highest type of aboriginal ceramic art in the United States. The Northwestern area is distinguished from this chiefly by the use of the wheel and the carved stamp in decoration. The North Atlantic group is characterized by crude materials and tempering and by ornamentation in straight-line elements instead of curved. This is also true of the Iroquois, but different from the former in shape. The South Appalachian area furnishes hard heavy ware, tempered with coarse sand and pulverized quartz. The vessels are pre-

dominantly of cauldron shape, ornamented with stamped design, and sometimes inlaid with bits of shell and stone. No colouring is attempted. In general excellence this area ranks second. In this connection the author discusses in detail the Gulf Coast and Florida. The technique of this area compares favourably with that of the Mississippi Valley. But there are no painted decorations. The designs are incised, and vary from the realistic to the highly-conventionalized forms. Of special interest is the pottery of the different layers of the shell-heaps in showing a gradual development of the art. The geographical fact that the peninsula of Florida reaches down toward an island area makes this question of interest. However, the relation between the various groups of pottery from this region and the large-type areas is not clearly demonstrated by the author. In fact, this part of the paper is lax in organization and systematic presentation, permitting the glorification of the specimens to obscure the real problem.

The chief categories of differentiation are the composition, as material, form, and ornamentation. Of these the first is regarded as quite important, but always disposed of by a bare statement, while the numerous plates and cuts are exclusively devoted to form and ornamentation. This practically restricts the treatment to the æsthetic aspect of the specimen. In other words, this book treats the geographical distribution of types of ceramic art as such. Having accomplished this, the author ceases. The interesting problems are the cause for the difference of type in their respective areas. The author passes these by with a mere assertion that they are regional or environmental rather than ethnic. Now, to describe the collections in a museum and demonstrate the geographical distributions of the same is laudable and necessary, but produces nothing, since it is preliminary to the real problem. The self-imposed limitations of the author are not faults; but since he is the authority upon the subject, we have a right to expect fuller treatment in the future. However, it is difficult to excuse the absence of some kind of a general conclusion to a production of such length.

Incidentally, the author gives a concise and direct exposition of the use and technique of pottery-making in the whole region.

The strong points of the work are the details and illustrations. The splendid index adds greatly to its value as a reference. Taken all in all, the paper is not only the most fruitful source of information upon the ceramic archæology of the region, but has few equals in any department of archæological research in America. G. W.

THE GREAT LANDSLIDE ON TURTLE MOUNTAIN.

The last annual *Report* of the Department of the Interior, Canada, contains the result of the examination made by the Geological Survey of the great landslide at Turtle Mountain on April 29, 1903. The Report was written by Messrs. R. G. McConnell and R. W. Brock. The facts here given are taken from it, together with two of the accompanying illustrations.

Turtle Mountain is a typical Rocky Mountain ridge, forming a part of the most easterly or front range of the mountains. It is built of westerly dipping beds, and its steep sides meet above in a sharp crest. The eastern face of the mountain overhangs the town of

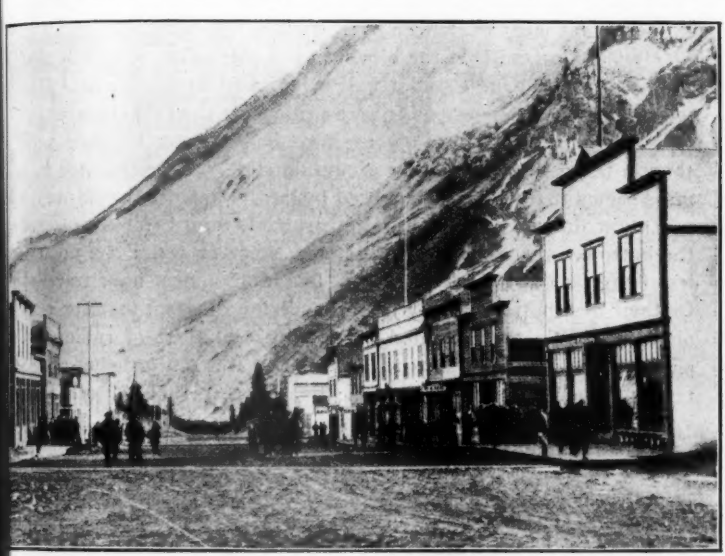
VIEW OF THE SLIDE LOOKING NORTHWARD.

Frank, in Alberta. Turtle Mountain rises directly from the valley of Old Man River, a rapid stream, 40 to 50 feet in width. The mountain is built of Upper Palaeozoic limestones above and cretaceous shells and sandstones below.

At dawn on April 29 a huge rock mass, nearly half a mile square, and probably 400 to 500 feet thick in places, suddenly broke loose from the east face of Turtle Mountain and precipitated itself with terrific violence into the valley beneath, overwhelming everything in its course. The great mass, urged forward by the momentum acquired in its descent, broke into innumerable fragments, ploughed through the bed of Old Man River, carrying both water and underlying sediments along with it and crossing the valley, a half mile wide, hurled itself against and up the opposite slope to a height of 400 feet. One of our pictures shows the denuded side of the mountain and the enormous stream of débris that was piled up across the valley. Blocks of limestone and shell

now cover the valley to a depth of from 3 to about 150 feet over an area of 1.03 square miles.

The number of persons killed was given at about 70. The property destroyed included the plant at the mouth of the Canadian–American Coal and Coke Company's mine, the company's barn, 7 cottages at the east end of the town of Frank, half-a-dozen outlying houses, some camps and ranches, and a considerable number of horses and cattle. The persons occupying the houses in the track of the slide were all swept away with it and destroyed. The town



DOMINION AVENUE, FRANK.

Only a part of the width of the slide is shown in this picture. The approaching wagon contains one of the injured persons.

of Frank lies on the farther side of the landslide, in the direction of the gap between the mountains. The second picture is a view of Dominion Avenue in this town, the part of which nearest the mountain was destroyed. A section of the landslide is shown at the farther end of the avenue.

The slide occurred about 4.10 A.M., when most of the inhabitants were asleep. The testimony of the residents threw little light on the character of the slide. They said the thud of the rock striking the valley bottom was distinctly felt, but the shock differed entirely

from an earthquake movement. The noise of the slide was described as resembling that of steam escaping under high pressure.

The estimates of the eye-witnesses as to the time and rate of movement range all the way from twenty seconds to two minutes. It is probable that the time between the first crash and complete rest did not exceed 100 seconds, and may have been somewhat less. The horizontal distance from the summit of the mountain to the end of the slide is 9,916 feet, and following the slope about two and one-half miles. As those awakened by the roar had scarcely time to do more than rise from their beds before all was over, the rate of movement must have been extremely rapid.

Heim estimated that the blocks in the great slide at Elm in 1881 travelled about a mile and a half in from 10 to 30 seconds. The material in this slide leaped from a projecting shelf right across the valley, and the movement on this account was probably more rapid than in the case of the Turtle Mountain slide. The separated rock mass seems to have been shattered by impact against the side of the mountain during its descent, and, probably long before it reached the bottom, into myriads of fragments, some of which were doubtless flung far out into the valley. The blocks must have travelled to their destination largely by a succession of great leaps or ricochets, probably accompanied by a certain amount of rolling and sliding. On the level flats the movement was onward, but with a tendency towards lateral dilation; but when terraces or other elevations were encountered a portion of the material was deflected and flowed along the the line of obstruction.

The slide rock consisted mostly of angular fragments of limestone, ranging in size from grains up to great blocks forty feet in length. Large rocks were common everywhere, and especially along the central portion of the slide. The greater part of the débris consisted of fragments from 3 to 20 feet in diameter. Much soft mud was derived from the bed of Old Man River, parts of which were scooped out probably down to the bed rock.

The surface of the slide was singularly uneven. The rocks were heaped up into mounds and short interlacing ridges enclosing hollows, somewhat resembling a terminal moraine. Peculiar conical mounds built of loose rocks up to 3 feet in diameter were observed at several points. The larger ridges were due in most cases to elevations in the old surface. A well-marked depression extended across the slide, due, apparently, to the protection of a rocky knoll to the south, which flung the greater part of the material across it.

The valley, of course, was completely changed, as the former

flats, and even terraces, were buried deeply under a mass of unassorted material. Old Man River was dammed at the lower part of the slide, and the channel above it became occupied by a chain of small lakes, with a depth of from 20 to 35 feet. Gold Creek was deflected to the west. The average depth of the whole of the slide rock amounted to about 45 feet. The contents of the mass, assuming 45 feet as the thickness, were about 47,857,820 cubic yards. This represents, approximately, 36,000,000 cubic yards of solid rock, equal in weight to about 80,300,000 tons. A rough estimate of the size of the mass which broke away, obtained by comparison of the old and new contour of the mountain itself, is somewhat greater, amounting to about 40,702,000 cubic yards, or 90,796,000 tons. No slide at all approaching it in size had hitherto been recorded in any part of the Canadian Rockies. Destructive landslides are frequent in the Alps, but none of those recorded have equalled this slide in extent.

The landslide was a breaking away of the mountain mass across the bedding planes. The mountain was ripe for such a catastrophe. The steep slopes, the shattered and fractured nature of the rocks, coupled with unusually heavy precipitation, are causes quite sufficient to have produced it. There is reason to believe, also, that the great chambers, 130 feet long, 250 to 400 feet high, and 15 feet wide, which had been dug in the coal mine directly at the foot of the mountain, must have weakened it.

The huge mass was in a state of unstable equilibrium, possessed a weak base, and was thoroughly traversed by fissure and jointing planes, in which water and frost were continuously at work, removing one by one the supports which held it in place. The heavy precipitation of the last few years accelerated this process, and recent earthquake tremors, no doubt, hastened the final disruption. The heavy frost on the morning of the slide, which followed hot days, appears to have been the force that severed the last thread and precipitated the unbalanced mass.

The zone surrounding the cavity left by the mass which broke away is excessively fractured and is doomed to fall. The north peak and shoulder overhanging the town threaten it with destruction, and it is recommended that Frank be moved a short distance up the valley beyond the reach of danger.

GEOGRAPHICAL RECORD.

AMERICA.

CHANGES IN THE ELEVATION OF LAND AND SEA AT NEW YORK CITY.—Mr. George W. Tuttle, discussing this question in the *American Journal of Science* (May, 1904), refers to the paper of the late Professor George H. Cook before the American Association for the Advancement of Science in 1857, in which he summarized the data which had led him to conclude that a gradual subsidence of the land was in progress throughout the whole length of New Jersey and Long Island, and inclined him also to think that it extended along a considerable part of the Atlantic coast. The self-registering tide gauge had only recently been introduced when Professor Cook read his paper, and tidal observations could not be obtained to determine the rate of subsidence. Since that time long series of tidal observations have become available; and upon the records obtained at Governor's Island, Sandy Hook, Fort Hamilton, and at two or three other points, for which Mr. Tuttle gives the annual means, he deduces conclusions as to the relative changes in the elevation of earth and sea in this neighbourhood. He also combines the results of the local observations with the facts that seem to have been established along the Baltic and other coasts, and sums up as follows the outcome of this study of tidal observations on both sides of the Atlantic:

(1) The mean sea-level oscillates in an irregular manner, having an average period of about eight years. These oscillations closely resemble one another at many ports distant from each other, and appear to be largely due to changes in atmospheric pressure and the resulting changes in wind velocities.

(2) The above oscillations compensate themselves completely in the course of time, and do not give rise to a continuous movement in a given direction.

(3) In addition to the above movements of the sea some ports show a more or less continuous rising of the sea relativeiy to the adjacent land; others a lowering of the sea-level in its relation to the land, and still others maintain a constant relation between the two. These latter make it clear that, except for the periodic changes noted above, the sea does not change its level, and that the relative changes are due to land movements.

(4) At various ports the rate of change in the elevation of mean sea-level referred to the adjacent land has not remained constant, but has varied to a considerable degree. All the observations show that for long periods the rate of change is less than took place in some part of the period, and the evidence is strong that the movement is not continuous, but oscillatory and confined within narrow limits.

(5) The observations at New York City show that since 1875 the land has been

subsiding relatively to mean sea-level by about 1.45 feet per century; but from the establishment of the self-registering tide gauge in 1853 to 1875 little or no change had occurred, and it is improbable that the present rate of subsidence will be continued indefinitely.

RAINFALL AND CROPS IN CALIFORNIA.—The relation of plants to the annual rainfall of any locality has always been a matter of interest, and has received a good deal of attention. The question is not a simple one to answer, because of the complications which arise from the influence of other factors than the rainfall, *e. g.*, the moisture of the soil, the character and distribution of the rainfalls, the time of planting, the kind and condition of the seed, the method of cultivation, etc. In a recent number of the *Monthly Weather Review* (January, 1904) there are given rainfall data compiled for San Francisco by Professor A. G. McAdie, which are of interest in this connection. Fifty-four years at San Francisco give an average annual rainfall of 22.74 inches, the annual variability, or probable variation of any year from the mean, being ± 4.00 inches. In other words, there is an even chance that any year at San Francisco will have a rainfall either between 26.74 inches and 18.74 inches or beyond these limits. During the fifty-four calendar years of records there has been one year with a rainfall of 11.37 inches, or 50% of the mean rainfall. The general distribution of the rainfall by calendar years is as follows:

TABLE I.—PRECIPITATION BY CALENDAR YEARS.

PERCENTAGE OF NORMAL.		PRECIPITATION IN INCHES.	NUMBER OF YEARS.	
Wet years, above 100%		Over 22.74	22	
Dry years	100–90%	22.74–20.47	13	32
	90–80%	20.47–18.19	7	
	80–70%	18.19–15.92	5	
	70–60%	15.92–13.65	5	
	60–50%	13.65–11.37	1	
	50–00%	11.37–	1	
				54

As far as crops are concerned whose prosperity depends on the winter rainfall, from October to April, inclusive, the rainfall should be averaged for the crop year, July–June, inclusive, rather than for the calendar year, January to December. When the San Francisco rainfall is thus summarized, as shown in the second table, the frequency of the dry years comes out differently, *i. e.*, there have been

fewer dry seasons, but more severe droughts than are shown in the first table by calendar years:

TABLE 2.—PRECIPITATION BY CROP YEARS.

PERCENTAGE OF NORMAL.		PRECIPITATION IN INCHES.	NUMBER OF YEARS.	
Wet years, above 100%		.....		26
Dry years	100–90%	22.74–20.47	7	28
	90–80%	20.47–18.19	9	
	80–70%	18.19–15.92	6	
	70–60%	15.92–13.65	1	
	60–50%	13.65–11.37	1	
	50–00%	11.37– ..	4	
				54

Professor McAdie states that the year 1885, which had a rainfall of 24.90 inches in the calendar year, but only 18.10 inches in the crop year 1884–85, was an "agricultural drought," with the lowest wheat yield in twenty years. The year July, 1881, to June, 1882, gave a seasonal rainfall of 16–14 inches, and the next year, July, 1882, to June, 1883, gave a rainfall of 20–12 inches, and yet these were good wheat years.

Discussions of this kind are of great value in all studies of climate and crops. An interesting contribution to this same general question may be found in Hinrichs' "Rainfall Laws, deduced from Twenty Years of Observations," Washington, 1893, referred to in the English translation of Hann's *Handbuch der Klimatologie.* R. DEC. W.

DEATH GULCH.—In *Science* for April 15, 1905, Dr. F. W. Traphagen contributes some notes on Death Gulch, in the Yellowstone National Park, a locality which has its greatest interest in the excess of carbon dioxide found there. In 1898 Mr. W. H. Weed, of the U. S. Geological Survey, found the bodies of five bears, one elk, and many small mammals at the bottom of the gulch, and concluded that death had been due to poisonous gas. In 1897 Dr. T. A. Jaggar, of Harvard, found the carcasses of seven grizzlies and one cinnamon bear. On May 3, 1898, the carcasses of eight bears were found by a corporal from the Soda Butte Station, who reported a feeling of dizziness at the bottom of the gulch, followed by a headache. On May 28th, 1898, the carcasses of seven bears and of one fox were seen. On August 10, 1902, a private found the carcass of one bear, which had recently died. Dr. Traphagen, in 1900,

counted the carcasses of four large bears, and saw the remains of many other animals, represented by bones, with occasional tufts of hair. A smell of sulphuretted hydrogen was noticeable. In August, 1903, an analysis of the air at the bottom of the gulch showed the presence of more than 10 per cent. of carbon dioxide, and strong traces of sulphuretted hydrogen. The gas literally poured from fissures on the sides of the gulch. At one crevice (14 by 4 inches) an analysis of gas showed more than 50 per cent. of carbon dioxide, and a little over 1 per cent. of sulphuretted hydrogen, although these figures are, if anything, too low. The wind blew at a fair velocity throughout the time when the tests were made, so that the conditions were favourable for a rapid diffusion of the gases. Sulphuretted hydrogen, when existing as from one part to three parts per 1,000, causes animals to die in ten minutes (Lehman), and it may be concluded, says Dr. Traphagen, that about one-tenth per cent. in air is sufficient to produce fatal results. Probably this gas would be more dangerous when associated with large amounts of carbon dioxide. The action of the gases of Death Gulch is intermittent, as was shown by the presence of maggots, which lived for a time, and were later killed when the gas became stronger. Flies caught and held in the gas escaping from the crevices died after ten seconds' exposure. All the members of the party noted a feeling of dizziness; while one had nausea, and another headache in addition. Dr. Traphagen, while working on his analyses, was almost overcome by the gas, and needed assistance in getting to fresh air. These analyses are the first from this interesting district, and are a decided addition to our knowledge of the peculiar conditions there found.

R. DeC. W.

CUSPATE FORELANDS.—The subject of cuspate forelands, or cusp-shaped bars, has already a literature of considerable size. Such large cusps as Capes Hatteras, Fear, Lookout, etc., have been studied chiefly from maps, but numerous small cuspate forelands have been described on the basis of actual field work. For the larger cusps a rather mysterious series of eddies from the Gulf Stream has been postulated; and tidal and other currents have been called on to account for some of the smaller cusps in arms of the sea. The writer of this note has described several perfect cusps (Amer. Geol., XXII, 1898, 1–12) in the Bras d'Or Lakes of Cape Breton, and assigned their origin to the work of wind waves approaching the coast diagonally. Recently (Journ. Geol., XII, 1904, 106–132) Mr. A. W. G. Wilson has described a series of cus-

pate forelands along the Bay of Quinté, on the Canadian side of the eastern end of Lake Ontario, in which he reaches a similar conclusion, eliminating, as the reviewer had done in the Bras d'Or Lakes, the possibility of current action. Wilson concludes that the material has been brought by waves associated with 'longshore currents; that the location of the cusps is due to the influence of "some more or less salient feature of the coast"; and that "their formation is due to the control exercised on wind direction and on wave direction by the form of the bay."

In view of the independent testimony of two workers in different fields that wave action is the cause for cuspate forelands in each of the instances studied, and, furthermore, in view of the fact that the hypothetical cusp-forming currents postulated to account for the large cuspate forelands are not even known to exist, and that the question of the influence of waves in making such forms has never been critically applied to the larger cusps, it seems important that some student of the subject should consider the application of the wave theory to these larger cusps. R. S. T.

Fracture Valleys.—Many years ago the explanation of valleys as the result of faults and fissures was common, and this explanation was made to do service on every hand. When the inevitable reaction set in against the absurd application of this theory, and when field studies brought evidence of absolute independence of valleys and neighbouring profound faults, it became the custom to consider faults and fissures as of very minor importance in the guidance of stream work. Several European geologists have, however, brought forward evidence that fracture lines have had a profound influence on topography, and recently Hobbs has brought this view prominently before American physiographers in his papers on the physiography of Connecticut. It is too early to pronounce positive opinion upon the full value of Hobbs's conclusions in the field in question, but it seems certain that he has succeeded in pointing out a weakness in the work of physiographers, by whom the full significance of joints and other fracture lines has not been appreciated. One of the first fruits of Hobbs's papers is found in a recent article by Professor Iddings (Journ. Geol., XII, 1904, 94–105), in which he discusses the drainage features of a part of the Yellowstone River valley north of the Yellowstone National Park. This region he had previously studied, but not with the possibility of a fracture drainage system in mind. On recently considering the question he finds numerous reasons for believing

that the valleys of this region are guided by fracture lines, and his paper is a statement of these reasons. He notes, among other evidences, a remarkable parallelism and angularity of the stream courses and a persistence of drainage lines across rocks of very diverse nature. Moreover, there is an apparent relation between stream courses and known fracture lines. It is not to be doubted that, now the matter is brought prominently forward, numerous cases will be found where joint planes and other fracture lines have had a decided influence on stream courses. R. S. T.

Fossil Topography.—It is by no means uncommon to find ancient topography revealed in cross-section where deep river valleys are cut down through some buried land surface; but ancient land surfaces, stripped and exposed to view as present-day topography, are not common. Considerable interest, therefore, attaches to Bayley's description of such a fossil topography in the Menominee Iron-bearing District of Michigan (Monograph, XLVI, U. S. Geol. Survey, 127–129). He points out that in its major features the present land surface is of pre-Cambrian origin, having been buried and preserved to the present time beneath Cambrian sandstones. The hills of this resurrected topography are higher, but less sharp and rugged, than those of the pre-Cambrian land, which was, moreover, cut by deep and narrow gorges preserved to us by sandstone fillings, not yet removed. Several of these preserved valleys have been revealed in the mining operations. The presence of gorges and valleys in the old land surface where none now exist explains the occurrence of certain of the ore deposits in positions where present topographic conditions are not especially favourable to their development. R. S. T.

Currents on the Southeast Coasts of Newfoundland.—The Canadian Department of Marine and Fisheries has just published a pamphlet under the title "The Currents of the Southeastern Coasts of Newfoundland," giving the results of the examination by the Tidal and Current Survey in 1903 of the currents along the European steamship route near those coasts. It was found that at all points along the steamship route, when more than five miles from the shore, there are no currents throughout the season in any direction that exceed a knot an hour. The only exception is the polar current, which sets very constantly to the southwest, for thirty or forty miles off the east coast with a maximum speed of 1.15 knots. On the south coast, within four or five miles of the shore, the cur-

rent is chiefly governed by the tide, and sets in opposite directions alternately. Farther out the tendency increases for the direction of the current to veer completely around the compass. The flat or pan ice runs with the surface current, and is much influenced by the wind; while icebergs indicate the average movement of the body of water as a whole, and the wind has little or no effect on them. Sealers, when working against a gale of wind, moor their vessel to an iceberg and lie in its lee; as they express it, the wind takes no hold on an iceberg.

CROPS, LAST YEAR, IN THE CANADIAN NORTHWEST.—A bulletin issued by the Canadian Department of Agriculture says that the total grain crop of Manitoba and the Northwest Territories in 1903 was: Wheat 56,228,437 bushels; oats, 47,215,479; barley, 10,448,461; linseed, 857,292. The area under crops in the Territories, this year, is estimated at 1,706,100 acres—an increase of 300,000 acres. A recent report of the United States Department of Agriculture gave the average yield of wheat for the past ten years, in North and South Dakota, at eleven and nine bushels respectively, while Manitoba claims an average yield of 20.1 bushels to the acre in the same period.

The number of immigrants into Canada in 1903 was 128,364, or nearly double the number of the previous year. Of the newcomers, 49,473 hailed from the United States, 32,510 from England and Wales, 9,282 from Scotland and Ireland, and 10,141 from Galicia (Austria-Hungary). Most of the immigrants go at once to the farm lands of the Northwest. The Canadian Department of the interior has recently issued a new and attractive guide-book for immigrants, entitled "Geography of the Dominion of Canada." It contains thirty-one large and small maps, besides many diagrams, pictures, statistics, and a large mass of information on the economic aspects of Canada.

AFRICA.

IMPORTANT RESULTS OF BOUNDARY DELIMITATIONS. — Reuter reports from Africa that an important result of the delimitation of the Anglo-Congo-German boundaries, which has been in progress for a year and a half to the west of Victoria Nyanza, is the discovery that the whole of Albert Edward Nyanza belongs to the Congo Free State, though its eastern shore has hitherto been represented as being in the British Protectorate of Uganda. In other words, the boundary between the two countries is found to be con-

siderably east of its supposed position. Great Britain thus loses an important strip of country, including the valuable salt deposits at the north end of Albert Edward Nyanza. That country is, perhaps, fully compensated by the further discovery that the Anglo-German boundary was inaccurately placed on the maps, and that, in fact, the whole of the lower third and navigable portion of the Kagera, the largest affluent of Victoria Nyanza, is in British territory instead of in German East Africa, as it has been shown on the maps.

THE PORT OF BIZERTE.—*La Compagnie du Port de Bizerte*, of Paris, has sent to the Society a volume of 140 pages, *Le Nouveau Port de Bizerte*, which commemorates the completion of the fine harbour works that have given to Tunis a port with first-rate modern conveniences and to France a splendid naval station. The geographical description of the place and its surroundings is from the pen of Onésime Reclus. The marked contrasts between the old and modern city, the building of the new port and the stimulus it has already given to the growth of Bizerte and its commerce, are fully portrayed. Many pictures and a number of maps show the city as it now is, and all the details of the new harbour, with its long jetties protecting the shore from Mediterranean storms, and the canal leading from these quiet waters past the new town on one side and the coal dépôts on the other to the inner port, one of the safest and most commodious of harbours. While the commercial development is still in its early stages, encouraging growth is indicated by the fact that the total number of vessels arriving increased from 455 in 1891 to 1,104 in 1902, the imports from 8,761 to 119,084 tons, and the arriving and departing passengers from 1742 to 9,811.

THE EASTERN DESERT OF EGYPT.—Very few attempts have been made to study in scientific detail the Egyptian Desert east of the Nile. As Schweinfurth and a few others have shown, it contrasts strongly with the desert west of the Nile. The latter is an almost unbroken expanse, without any prominent ridge for hundreds of miles; while the Eastern or Arabian Desert is a wilderness of ranges rising from 1,000 to 2,000 metres, surrounded or flanked by a maze of low hills. Only towards the Nile does it show the broad plateau character and abrupt escarpment that mark the Nile valley.

The "Topography and Geology of the Eastern Desert of Egypt,

Central Portion," is one of the most valuable of the reports that the Geological Survey of Egypt has recently issued. It was written by T. Barron and W. F. Hume, who give the topographical and geological results of two practically independent survey parties in 1897–8. The region surveyed may be roughly indicated as lying between the parallels of 26° and 28° N. and between the meridian of 33° east and the Red Sea. The volume of 331 pages contains numerous maps and handsome photogravures, showing many striking aspects of the desolate region. A few nomadic Arabs now wander over it, most of the population living near the seacoast or the Nile. During the Roman occupancy the region was turned to rather more account, and many quarries of ornamental building stone were worked and also deposits of iron ore.

The most striking topographical results are that the flat expanses are comparatively narrow, but of great length; all the western drainage joins the Wady Qena, and thus enters the Nile valley at that town; the Red Sea hills do not form "a continuous chain, but a series of ranges, advancing in echelon, each new longitudinal massif to the south being further east, though remaining parallel to its predecessor"; the mountains are to a considerable extent cut into blocks by longitudinal and transverse rifts; the Nubian sands and softer sandstones are the chief cause of many of the great plains and minor valleys.

A mass of information on the geology of the region fills 174 pages, much of it bearing on generalizations relating to the structure of the country. Only a few of the more interesting conclusions can be mentioned here. In the raised coral beaches of the Red Sea most of them do not attain a greater thickness than four metres, and are found to be based on all kinds of rocks, whether igneous or sedimentary. The oldest sedimentary rock is the Cretaceous Nubian sandstone. The authors found that the present channel of the Nile at Qena cuts through gravels of Pleistocene Age, and they advance the suggestion that the river did not begin to flow in its present bed at that point till late Pleistocene times.

POLAR REGIONS.

CANADA BUYS THE GAUSS FOR CAPTAIN BERNIER.—The Canadian Government having paid $75,000 for the steamship *Gauss*, which was built three years ago for the German Antarctic Expedition at a cost of $125,000, Captain Bernier and a crew of 22 men were recently sent to Germany to man the vessel and bring her across the ocean. When she arrives in Canadian waters she will be

sent out, under Captain Bernier, to carry relief stores and coal to the Government steamer *Neptune*, which wintered in Hudson Bay. Later this season the *Gauss* will be engaged in survey work on the coast of Labrador.

The Canadian Government had pledged its financial support to Bernier's project for Arctic exploration, provided he should first secure subscriptions to the amount of $60,000. He reported, early last winter, that all but $13,000 of the required sum had been secured. It is now said that the Government will send him to the Arctic early next year in an attempt to reach the north pole from Canada; and that his plan is to put the *Gauss* into the ice somewhere to the north or northeast of Bering Strait, in the expectation that she will drift towards the pole.

THE PRINCE OF MONACO'S ARCTIC PROJECT.—According to *Globus* (No. 16, 1904), Prince Albert of Monaco is planning an Arctic expedition, with the north pole as his goal. He purposes to employ Nansen's plan of drifting across the polar area in the pack—a method of exploration that requires much time, but, in the opinion of Prince Albert, promises better results than any other.

PICTURES TAKEN BY THE SWEDISH ANTARCTIC EXPEDITION.—In its first number this year *Ymer* prints papers by Dr. O. Nordenskjöld, Dr. J. G. Andersson and Captain Larsen on the work of the Swedish South Polar Expedition, 1901–1903 (see BULLETIN, 1904, Jan., pp. 22–29, for Nordenskjöld's narrative). Very little of the region of Graham Land has been caught by the camera, and the photographs in *Ymer* are unusually interesting. Some of them are quite comprehensive; one taken on Seymour island discloses a part of the low foreshore of the northern part of that island with the odd truncated cone of Cockburn Island rising in the distance, and, far away, the coasts of the much larger Ross Island. Capt. Larsen took a snapshot at the sinking *Antarctic* when all that was visible was the tops of the masts and the pennon still afloat. The boiling and bubbling streak of water where she went down contrasts with the widespread ice-fields that hem it in. Another view shows the low, square stone hut in which Andersson and his two comrades lived during the winter darkness. In comparison, the comfortable house erected as the Nordenskjöld headquarters on Snow Hill is quite palatial in appearance.

GENERAL.

THE BUBONIC PLAGUE.—Dr. E. B. Barnet, Secretary of the Cuba Board of Health, wrote a paper on "La Peste Bubónica" last year which the Government has printed in Spanish for gratuitous distribution. It will be remembered that in the last decade this infectious disease was very prevalent in parts of southern Asia and that among 220,907 cases in the Presidency of Bombay 164,083 were fatal. The disease was carried to various ports of Europe and America, including New York City, but in most of the Occident, owing to the vigilance of the health anthorities, it was prevented from spreading. Among the illustrations in Dr. Barnet's pamphlet are two maps, one of them locating five areas in Asia and one in Africa which are regarded as permanent foci of bubonic plague. In these districts the disease seems never to be completely extinguished, and from one or another of them it sometimes issues to attack regions where unsanitary or climatic conditions favour its development.

These foci are in northern Tonkin, in India north of the middle Ganges, in Afghanistan northwest of Candahar, in Northern Persia between Meshed and the Caspian, in the southern part of the Euphrates and Tigris basins, and in the Benghazi district of Tripoli.

In the zone between the United States and Central America cases have occurred in recent years at nearly every important port from Mazatlan on the Pacific coast of Mexico to Havana and Matanzas. The pamphlet deals with the transmission of the disease, its diagnosis and treatment, and the sanitary measures which should be taken against it and other forms of infection.

HEALTH RESORT IN LAPLAND.—The proposed establishment of a health resort in Lapland, reported by the *British Medical Journal*, is an announcement which will occasion no particular surprise in the mind of any one at all acquainted with the great advantages which many Arctic climates possess in the summer months. It is certain that before long summer resorts will be developed in many northern lands which used to be thought ice-bound and inhospitable all the year round. The new sanatorium is to be erected on the shores of Lake Torne, a beautiful sheet of water at Wassijaure, near the terminus of the Ofote Railroad. There is a small settlement at Wassijaure, but otherwise there is no sign of man except during the occasional passage of a few Laplanders with their reindeer. As recently noticed in the BULLETIN, a scientific station has already been erected, by means of private subscriptions, the work

to be done there including investigations in zoology, geology, botany, and entomology during the summer, and in meteorology and magnetism during the winter. R. DEC. W.

PELÉLITHS.—Since Hovey and others described the peculiar spine or tooth which last year rose from one side of the crater of Pelé a number of instances of peculiar volcanic spines have been described. Thus Strachey (Nature, Oct. 15, 1903) describes a peak in India which resembles the Pelé spine; Russell (Amer. Jour. Sci., XVII, 1904, 253–268) describes instances in the western United States which seem like that of Pelé; Bogoslof Island in the Aleutian chain, which rose above the sea late in the 18th century, has been compared to the Pelé spine; and Winchell (Amer. Geol., XXXIII, May, 1904, 319–325) adds other instances. He furthermore raises the question whether some of the so-called volcanic necks or plugs of the western United States, such as the peak of Mt. Taylor, New Mexico, and Mato Teepee, South Dakota, are not of similar nature. For such forms he proposes the name *Peléliths*, and suggests that it is desirable that extinct volcanic peaks and necks be re-examined in the light of the new facts revealed by the elevation of the remarkable Pelé spine. R. S. T.

THE INTERGLACIAL PERIOD.—A recent article in Swedish by Dr. N. O. Holst, abstracted in the Geological Magazine (Decade V, Vol. I, No. 476, 1904, pp. 56–59), calls sharply in question the conclusion of numerous European glacial geologists regarding the complexity of the glacial period. Two moraines, quite different in appearance and separated by a series of stratified deposits, have been accepted by many European glacial geologists as proof of two glacial periods with an interglacial period. Holst discusses the characteristics of these deposits, and states numerous objections to the current explanation. According to his interpretation of the phenomena, the two moraines are merely different phases of deposit from a single ice invasion; while the so-called interglacial beds are of intermorainic origin and a mere phase in the deposit of a single series of ice deposits during a single ice advance. Mr. Lamplugh, who supplies the abstract for the *Geological Magazine*, says: "The doubts as to the validity of the evidence for even a single Interglacial Period, which have been expressed recently in several countries, are here put forward with great force, and it is clear that a general re-discussion of this very important question is rapidly becoming imperative." R. S. T.

EXCAVATION OF HERCULANEUM.—The London *Times* announces that the complete excavation of Herculaneum is to be undertaken. It is proposed that this vast work be carried out by the co-operation of Italy with all civilized countries, and that there be a central managing committee at Rome, with national committees elsewhere. Since the first excavations of the theatre to a depth of 27 metres, in 1738, only five small and tentative excavations have been made. No excavations on a large or comprehensive scale have ever been attempted, because the town of Resina was built over the site of the buried city, and there seemed, also, to be great natural difficulties in the way. These difficulties are said now to be overcome.

GOLD PRODUCTION IN 1903.—The *Mining and Engineering Review* says that the world's production of gold in 1903 was $327,049,750, or about $67,000,000 more than in 1901, and $28,000,000 more than in 1902. The countries contributing most largely were the United States, $74,425,340; Canada, $19,000,000; Mexico, $12,550,000; Russia, $24,000,000; Transvaal, $61,527,231; and Australasia, $88,170,909.

M. FROIDEVAUX'S PARIS LETTER.

PARIS, March 31, 1904.

The success of Capt. Lenfant's exploration makes it proper to sketch the part taken by the Comité de l'Afrique Française in aiding the development of Africa. The association was formed in 1890, at a time when the public interest in the work of our officers and explorers in Western Africa and the Congo was hardly more than platonic, though already, at the close of the year 1889, private enterprise had organized the expedition of the ill-fated Paul Crampel and that of Lieut. Mizon, on the Niger. The supporters of these undertakings founded in October, 1890, the Committee of French Africa, for the purpose of developing the influence and the commerce of France in Central, Western, and Northern Africa. There is no mention made of scientific aims; none the less the Committee has accomplished in the fourteen years of its existence a truly scientific work.

The task before it was to unite at Lake Chad Algeria, the French Sudan, and the French Congo, and to perform this it was necessary

to outdo the activity of the German and English explorers bent on reaching the same goal.

Paul Crampel was assassinated at El Kuti in May, 1891, by the Senussi. His work was taken up by Dybowski, who avenged his predecessor's death, and pushed farther to the north, and by Casimir Maistre, who, from the French Congo, penetrated to Bagirmi, and from there to the River Benue, which he descended to the Niger, marking off in this way the regions of the Shari and the Chad, as well as the Central Sudan, which had just been crossed by Colonel Monteil. A little later the Committee lent its support to a new expedition under Lieut. Mizon, who, starting from the Niger, ascended the Benue, and met on the banks of the Sanga Savorgnan de Brazza, who had made his way from the Congo.

The result of these journeys was the Convention of 1894, which limited the advance of the Germans towards the east, and regulated their access to the southwestern shore of Lake Chad, while it secured the extension of the French Congo to the Lake.

The efforts of the English and the Germans to prolong towards the bend of the Niger their establishments on the Guinea Coast were successfully opposed by a series of expeditions which consolidated the *hinterland* of the Sudan, Guinea, the Ivory Coast, and Dahomey.

The Franco-German Convention of 1897, and the Anglo-French Convention of 1898 once signed, the Committee turned its attention again to the Chad, where three expeditions, sent out from different directions, finally met in April, 1900, and completed the great plan conceived by Paul Crampel.

The Committee of French Africa is fairly entitled to claim as its own an important part of the work done in constituting the present French African empire.

An interesting address on Borgu, in Upper Dahomey, was lately made before the Société de Géographie by M. Georges Brousseau. Charged with the administration of Borgu in 1901–1903, M. Brousseau found opportunity to map the country and to form a mineral collection, now under examination in the laboratories of the Sorbonne. The great table-land of Borgu, of more than 16,000 square miles, is described as a region of varying capabilities; the soil is really fertile in the depressions, while the upper surface, which is covered with micacious gneiss, is poor. It is admirably supplied with water by the streams flowing directly to the Gulf of Guinea, or by the affluents of the Niger. The climate is not unfavourable to the European, and there is a marked difference in the landscape

with the change of the seasons. The population is about 60,000—Baribas, Dendis, Peulhs, Nagots—Mussulmans or fetishists, all, except the nomad Peulhs, cultivators of the soil. With increased facilities of communication Borgu cannot fail to become rich. The same may be said of the country between 10° and 12° N. Lat., and 2° 20′ and 4° 20′ E. Long., the land of the Cafiris, of whom Lieut. Brot gave an account to the Société. These people are industrious tillers of the soil and great hunters, but they go without clothes.

The Asiatic journey of Capt. Anginieur from Ferghana to Kashmir through the Takla-Makan Desert and the Karakoram was made in company with the American explorer, Mr. Crosby, who took notes of their route. From Yarkand to Khotan the travellers followed the itinerary of the unfortunate Dutreuil de Rhins in the western Takla-Makan. They identified the source of the Karakash River, and discovered, at the cost of great sufferings and at the peril of their lives, a road across the Aksai-Chin Desert.

The Ubangi-Shari mission, directed by M. Chevalier, has returned successful from its three years and a half in Central Africa, where, besides making very complete collections, it established at Krébedjé, on the Tomi River, a thoroughly-organized garden. The watershed of the Ubangi, the Shari, and the Nile was found on the borders of Darfur; the Mamun marsh was explored, the lake Iro, with its lake-dwellers, and the bed of the dry lake Dekakire. North of the 12th parallel there was no vegetation but the thorny mimosas. Kanem is no more than a steppe, undergoing progressive desiccation, like the country surrounding the Chad. The observations of this mission confirm those of preceding explorers, and it may be regarded as settled that of all the regions visited none presents a real economical interest but the portion of the Shari basin which has Palem-Gundi for its capital, and the shores and islands of the Chad.

In Asia M. Bons d'Anty, Consul of France at Chengtu-Fu, capital of Süchwan, besides a journey by water to Kia-Ting, undertook and completed an exploration along the *massif* of the Liang-shan mountains, inhabited by the independent Lolos. M. Bons d'Anty is convinced that the dominant element in this population is identical with the aborigines of Yunnan. This identity suggests to him that we have here, perhaps, the key to the ethnological problem of Indo-China.

If the number of new publications is not great, several of them are of real value.

Dobrogea, the title of a work on the Dobrudja by M. Grégoire

Danesco, is a study of the physical geography and the ethnography of a region too little known. Two chapters are devoted to the bibliography and the cartography of the subject, and there are ten interesting maps.

M. Foureau had just brought out the first Part of the Scientific Documents of the Saharan Mission, which crossed the Great Desert from Algeria to the Congo by way of Lake Chad. This first part contains the astronomical and the meteorological observations. The three daily readings of the thermometer and the barometer were of the greatest service in the determination of altitudes, and the table printed in this publication (p. 157) furnishes the first precise indications of the relief in that part of the Central Sahara crossed by the Foureau-Lamy expedition. The same may be said with regard to the temperature.

There will be several parts of these scientific documents and an Atlas of the maps on a scale of 1:400,000. The work will be finished at the end of the year.

For the more western Sahara are to be noted in the Bulletin du Comité de l'Afrique Française the meteorological observations of Lieuts. Guillo-Lohan and Pichon in the Tuareg country, and the work of Lieut. Besset and M. Flamand on the geology of the district between In Salah and Amguid.

The Ministry of the Colonies has published maps of Western Africa: one in six sheets covering the whole region, on a scale of 1:2,000,000, and embodying the latest information; another in four sheets of the mining districts of the Ivory Coast, on a scale of 1:250,000. In this map the configuration of the lagoons is almost entirely changed from that of previous maps.

The same Ministry has published a map of Mayotte and the Comoro Islands on a scale of 1:200,000.

M. E. F. Gautier calls attention to an interesting fact in physical geography in Madagascar: the capture of the Mahajamba by the Kamory, a little affluent of the Betsiboka.

HENRI FROIDEVAUX.

THE CORNELL SUMMER SCHOOL OF GEOGRAPHY.

The second session of the Cornell Summer School of Geography will be held at Ithaca, N. Y., from July 7th to August 19th. The marked success of the first session, in 1903, has led to a practical duplication of the courses given then, though with a few additions; and the faculty is essentially the same.

Professor Tarr, of Cornell, offers a course on the Geography of Europe, and one on the Physical Geography of the land, consisting of three parts—lectures, laboratory, and field work (in the two last parts assisted by Messrs. Carnes, Hubbard, and Whitbeck); Prof. Brigham, of Colgate, gives a course on the Geography of the United States, and one on Dynamical Geology, consisting of lectures, laboratory, and field work (in the two last parts assisted by Messrs. Carnes, Emerson, and Hubbard); Professor Carnes, of Dennison University, offers a lecture and laboratory course on Elementary Meteorology; Mr. Hubbard, of Cornell University, a course on the Geography of Tropical Countries; Principal Emerson, of the Cobbett School, Lynn, Mass., a lecture, laboratory, and field course in Commercial Geography; Supervisor Whitbeck, of the New Jersey State Normal and Model Schools, two courses—one on Geographic Influence and Relations, the other on Aims and Problems in Geography; and Prof. A. McMurry, of the Northern Illinois Normal School, a course on Home Geography, and one on Type Studies in Geography for Grammar Grades. In addition, a Five Day Field Excursion on the Appalachians and the seacoast, conducted by Prof. Tarr, is also announced; and a weekly Round Table Conference, in which all the students and instructors take part, discussing questions of general interest in geography teaching. Last year this proved to be one of the most valuable features of the School, giving students and teachers opportunity to become acquainted and to exchange views.

The object of the Cornell School is to provide opportunity for teachers of various grades to assemble in a favourable locality, under University influence, and pursue courses in geography given by recognized specialists on a variety of topics both on the scientific and the pedagogical side. Any doubt that may have existed as to the possibility of accomplishing this object was dispelled by the experiment of 1903, when teachers from seventeen States, including superintendents, principals, Normal School teachers, teachers

in the high schools, and grade teachers, representing every grade of specialization in geography, worked side by side with great enthusiasm, that the great majority attended lectures from 8 o'clock to 1, and laboratory or field work from 2 to 6 on Monday, Tuesday, Wednesday, and Thursday, and all-day excursions on Friday and Saturday. The combination of indoor and outdoor work made such close application possible without injury to health.

Cornell University is admirably situated for a school of geography. Within easy reach of the Campus are many geographic features of exceptional interest, including Lake Cayuga, and many beautiful gorges and waterfalls. Fifteen afternoon or all-day excursions are made to points of geographic interest, besides four larger excursions to more distant points—Watkins Glen, the shore of Lake Ontario, the coal fields at Wilkes Barre, and Niagara. A special feature is made of these geographic excursions, and also of excursions for the study of commercial geography; and the full use that is made of the rich field adds greatly to the value of the instruction. In several of the courses the field work is made the basis of illustration of the application and use of field instruction in the schools; and throughout there is an effort to regulate and apply the work of the various courses in such a manner as to make them of most use to teachers.

RETURN OF THE BRITISH ANTARCTIC EXPEDITION.

On April 1 news came of the safe arrival of the *Discovery*, accompanied by the two relief ships, the *Morning* and the *Terra Nova*, at Lyttelton, N. Z. The *Scottish Geographical Magazine* (May, 1904) contains a summary of the expedition's work during its second year and of the *Discovery's* extrication from the ice.

The two relief ships reached the neighbourhood of the *Discovery* off the edge of the ice on January 5. Towards the end of January the ice began to weaken, and in the early days of February the opening had advanced within eight miles of the *Discovery*. Its advance was slow, but was increased by systematic blasting with dynamite. On Feb. 12th a general break-up of the ice began, and on the 14th the explosion of two heavy charges placed the *Discovery* in open water. Subsequently a period of heavy gales began, placing both the *Discovery* and the relief ships in jeopardy, but 75

tons of coal were successfully transferred to the former. The voyage to New Zealand was very rough, but the *Discovery* succeeded in proving the non-existence of the extreme eastern part of Wilkes Land, as hitherto represented on the map, and the fact that the Balleny and Russell Islands are identical. She sailed between these islands and the mainland—a passage never before accomplished. Further exploration was prevented by the shortage of fuel.

According to the account given to the press by Captain Scott, the winter of 1903 was less trying than that of 1902. The weather was colder, but less windy; one hundred degrees of frost were, indeed, recorded in May. In September sledging was again begun, and, in spite of the want of dogs, no less than seven important expeditions were made. The temperatures during these expeditions were very low. The following were among the more important of the sledge journeys:

On October 6, Messrs. Barne and Mulock, with four men and a supporting party of six, started for the strait in lat. 80° south. They encountered continuously bad weather and very heavy surfaces, but eventually reached the strait, and found that it contained a large glacier formed from the inland ice. Detailed information was obtained as to the exact point of junction between the barrier-ice and the land, and a dépôt established last year was found to have moved a quarter of a mile to the north. The party returned on December 13.

Messrs. Royds and Bernacchi, with four men, started on Nov. 10, with five weeks' provisions, and reached a point 160 geographical miles southeast of the ship, travelling continuously over a plain. No trace of land and no obstacles in the ice were encountered, and evidence was obtained showing this vast plain to be afloat. Mr. Bernacchi secured a most uniform series of magnetic observations. These journeys were performed under very unfavourable conditions of weather and ice surface.

Captain Scott and Mr. Skelton, with four men and a supporting party of six, set out to the west on October 12, and on October 18 reached a height of 5,000 feet on the glacier, 80 miles from the ship. Here the sledges failed on the hard ice surface, and forced the party to return to the ship. Another start was made on the 26th with a small party, which was delayed by the strong winds blowing from the summit of the heights, and was forced to remain six and a half days in camp, during which time the icy gale continued. The party gained the summit on November 11, and crossed

the magnetic meridian on November 20, in about long. 155° 30′ east. Captain Scott then proceeded west with two men, Evans and Lashly, for eight and a half days, and reached a point 270 miles from the ship, in lat 78° south and long. 146° 30′ east. The glacier was regained on December 14 and the ship on Christmas Eve.

The result of these two last-named journeys is to show that the interior of Victoria Land stretches continuously at a height of 9,000 feet, and is evidently a vast continental plateau. No land was visible above the ice after losing sight of the ranges which front the coast. The glacier valley affords magnificent scenery, and gives a natural geological section of the mountain. Mr. Ferrar and two men accompanied Captain Scott to the summit, and on the return journey they explored the valley in detail, and discovered sandstone, with plant remains. The plants are dicotyledons, probably of Miocene Age.

The result of the journeys made respectively by Messrs. Royds and Bernacchi and Lieutenant Barne and Mr. Mulock is to confirm the conclusion previously arrived at by Captain Scott, Lieutenant Shackelton, and Dr. Wilson, that the whole of their great sledge journey of the previous year was made on sea-ice. It would thus seem that there is a great arm of the sea which extends southward for an unknown distance between Victoria Land on the west and the rising land at the east end of the great Ross Barrier.

The expedition has thus resulted in a large addition to geographical knowledge, and it must be a source of great satisfaction to all to know that the *Discovery* has returned to civilization in safety and, with the exception of the sailor who lost his life during the first year, without leaving a man behind.

NEW MAPS.

AMERICA.

ALASKA.—Map of Alaska. Natural scale, 1:2,500,000, or 39.4 statute miles to an inch. Contour interval, 1,000 feet. Compiled by E. C. Barnard, topographer, under the direction of R. U. Goode, geographer. Preliminary Edition. U. S. Geological Survey, Washington, D. C., 1904.

This notable production marks a turning-point in the mapping of Alaska. It is the first map to express the topographical features or relief of the Territory by means of contours. This desirable end was made possible by the work of numerous Geological Survey parties in the six years, 1898–1903, the coast surveys of the U. S. Coast and Geodetic Survey and maps supplied by the Army and Revenue Marine Services,

the Canadian Government, and other sources. The map is the result, in fact, of the great recent activity in carrying out accurate surveys which now cover about 150,000 square miles of the total area of about 590,000 square miles. At least two-thirds of the remainder of the Territory have been roughly mapped. An inset shows the areas that have been covered by surveys, thus indicating the cartographic data that are most reliable.

The growing interest in the Territory, due to the development of its mining and other resources, makes the map a most timely contribution to our knowledge of Alaska, notwithstanding the fact that it is based only in part on accurate mensuration. Changes will be necessary in later editions, but we have the authority of Mr. Alfred H. Brooks for the statement that the general facts of the relief and drainage are known to be correctly indicated on the present map. This is a great deal more than any earlier map has given us.

Though the contour interval is 1,000 feet, the lines, of course, are quite close together among the steeper mountains on this map of comparatively small scale. The brown of the contours contrasts sharply with the blue of the glaciers, and thus the areas in which glacial activity is now conspicuous are brought out clearly.

CANADA.—Geologische Karte von West-Canada. Natural scale, 1:7,500,000, or 118.35 statute miles to an inch. *Petermanns Mitteilungen*, Vol. 50, No. 1. Justus Perthes, Gotha, 1904.

The geological detail, based on the work of the Geological Survey of Canada, is laid down on a part of sheet 83 of the latest edition of Stieler's Handatlas. The accompanying letterpress is by Prof. Dr. H. Haas of Kiel, who adds a bibliography to his systematic discussion of the geology of the whole of Canada.

CANADA.—Les Ports Canadiens. 13 plates: 1—Gulf of St. Lawrence and St. Lawrence River. Scale, 1:3,000,000, or 47.34 statute miles to an inch; inset of Halifax harbour; includes the gulf and river to Quebec. 2—St. Lawrence River between Montreal and Quebec. Scale, 1:600,000, or 9.4 statute miles to an inch; profile of river-bed. 3—Montreal. Scale, 1:25,000, or 0.39 statute miles to an inch. 4—Profiles of wharves, dikes, etc., at Montreal. 5—View of the river front at Montreal. 6—Harbour dredge. 7—Quebec. Scale, 1:25,000; profiles of elevators, etc. 8—Plans of commercial basins at Quebec, with transverse sections of embankments and height of water at various stages of the tide. 9—Plans of dry docks at Quebec and Halifax. 10—Halifax. 11—St. John. Scale, 1:25,000; cross sections of breakwater and piers. 12—Proposed Chignecto Ship Canal between the Bay of Fundy and Gulf of St. Lawrence. Scale, 1:200,000, or 3.1 statute miles to an inch. 13—Eastern Canada (Quebec and Ontario). Scale, 1:1,500,000, or 78.9 statute miles to an inch. Vve Ch. Dunod, Paris, 1898.

UNITED STATES.—Les Ports des États-Unis. 48 plates. 1—Roadstead and Port of Portland (Me.). Scale of bay, 1:50,000, or 0.7 statute miles to an inch; scale of port, 1:15,000, or 1,250 feet to an inch. 2—Sandy Bay. Scale, 1:20,000, or 0.3 statute miles to an inch; contours showing limits of highest and lowest tides along the beach. 3—Boston and its environs. Scale, 1:80,000, or 1.2 statute miles to an inch. 4—Reclaimed lands in Boston Harbour. Scale, 1:25,000. 5—Railroad terminals in Boston (showing their relations to one another and the docks). Scale, 1:25,000. 6—Plans of railroad terminals in Boston. 7—New York and its environs. Scale, 1:150,000, or 2.38 statute miles to an inch. 8—Port of New York (Channels of the Lower Bay, scale, 1:50,000; and Brooklyn water front from Gowanus Bay to Buttermilk Channel, scale, 1:12,500. 9–10—Plans of dredges at New York. 11—Port of New York (showing pier line and docks from Buttermilk Channel to 72d Street,

including New Jersey from Communipaw to Weehawken). Scale, 1,25,000. 12–27—Plans, sections and views illustrating the construction of docks, elevators, railroad terminals, ferry stations, ferryboats, bridges, etc., at New York. 28—The Delaware (including Delaware Bay from the Atlantic to Philadelphia). Scale, 1:300,000, or 4.73 statute miles to an inch; profiles of breakwaters, ice-breakers, etc. 29—Plan of Philadelphia. Scale, 1:50,000. 30—Philadelphia water front (Delaware), with water front between Market and Reed Streets, on enlarged scale. 31—Philadelphia railroad terminals. 32–35—Baltimore with its environs, docks and terminals. 36–41—Newport News, Portsmouth and Norfolk, with special attention to the shipbuilding plant and the railroad terminals. 42–43—Charleston, S. C., before and after the construction of the jetties. 44–45—Savannah and the terminals of the Georgia Central R.R. 46—Elevations and plans of the "Puget Sound Dry Dock." 47–48—Atlantic Coast of the United States. Scale, 1:2,500,000, or 39.4 statute miles to an inch. Vve Ch. Dunod, Paris, 1904.

These two fine series of maps, plans and views respectively illustrate Vol. I and III of "Les Ports maritimes de l'Amérique du Nord sur l'Atlantique," written by Baron Quinette de Rochemont and H. Vétillart, the last volume of which has just been printed. The maps are excellent reproductions of official hydrographic and port surveys in Canada and the United States. Soundings are given in metres and decimetres, the limits of navigable channels in rivers are indicated, and very many contours of the sea and river beds are shown. Most of the port plans are large enough to show all important details of the water front; and especial attention is given to the facilities for transshipment between land and water. The numerous plans and profiles showing in considerable detail the instruments by which the various harbour improvements are made will particularly interest engineers.

THE UNITED STATES.—Geologic Atlas of the United States.

No. 99. Mitchell Folio, South Dakota. Area, 863 square miles between parallels 43° 30′ and 44° N. and meridians 98° and 98° 30′ W. Nearly a smooth plain sloping northeast and broken only by the beds of streams which have banks of moderate height. The surface is naturally covered with grass only near the James River and at a few points along its tributary Firesteel Creek. The surface is mantled with glacial deposits, under which, as many deep wells show, are extensive sheets of clays and sandstones of Cretaceous Age resting on a floor of quartzite and granite, possibly of Archean Age. The older rocks are frequently exposed along the James River, but metamorphic or igneous rocks are found on the surface only as boulders in the drift. The James River and Firesteel Creek are the only streams with running water the year around. Several water-bearing beds in the Dakota and Benton sandstones yield more or less adequate supplies for irrigation. The soils are stony, sandy, and clayey.

No. 100. Alexandria Folio, South Dakota. Area, 863 square miles. It adjoins the Mitchell quadrangle on the east and largely shares its characteristics. The artesian water supply is more copious than in the Mitchell quadrangle, the lower horizons of the Dakota sandstone particularly affording an abundant supply.

No. 102. Indiana Folio, Pennsylvania. Area, 227 square miles between parallels 40° 30′ and 40° 45′ N., and meridians 79° and 79° 15′ W. It is in the Appalachian province, its drainage is entirely into the Allegheny River, and it conforms in geologic structure with the Allegheny Plateau. The rocks are bent into a series of low folds, which decrease in magnitude westward. The mineral resources are coal (thus far mined chiefly for local supply), natural gas, clay, sandstone, limestone, and sandy and clay loam soils, which, with intelligent treatment, yield profitable returns.

XUM

BRAZIL.—Übersicht der Regenteilung und der Meteorologischen Stationen in Süd-Brasilien. Scale, 1:7,500,000, or 118.3 statute miles to an inch. Justus Perthes, Gotha, 1904.

The map accompanies the monograph by E. L. Voss, entitled "Beiträge zur Klimatologie der südlichen Staaten von Brasilien," which forms Supplement No. 145 to *Petermanns Mitteilungen*. Five tints show the mean annual precipitation in the area comprising the States of São Paulo, Paraná, Santa Catharina, and Rio Grande do Sul. The German colonies are indicated, and the meteorological stations whose data were utilized are distinguished from those that have newly been erected. Diagrams show the average daily range of temperature and rainfall in some of the towns.

EUROPE.

SCOTLAND.—Bathymetrical survey of the freshwater lochs of Scotland. (1) Natural scale for separate maps of the lakes, 1:21,120, or one statute mile to three inches. (2) Natural scale for map of head waters of the Tay, with surface geology, 1:127,000, or two statute miles to an inch. Under the direction of Sir John Murray and Laurence Pullar. The *Geographical Journal*, January and April, 1904.

The January instalment of these fine maps concludes the work of the survey among the lochs of the Tay basin and deals with over thirty of the smaller lochs. Fifteen tints on the map of the upper Tay show the distribution of the surface geological formations and the lines of faulting, including the great fault along the Highland border which divides the Tay basin geologically into two parts, the metamorphic rocks of the eastern Highlands on the northwest and rocks of Old Red Sandstone Age on the southeast. The April instalment presents twenty lochs in the Assynt district of Sutherlandshire, which drains about 150 square miles, or twelve times the area of the lochs.

ASIA.

CHINA.—Wege-Aufnahmen im Gebirgslande des Ta-pa-shan. Natural scale, 1:400,000, or 6.3 statute miles to an inch. By Dr. Karl Vogelsang. *Petermanns Mitteilungen*, Vol. 50, No. 1, 1904.

The map illustrates a paper by Dr. Vogelsang, a Prussian mining assessor, on his month's journey in 1900 to the north of the Yangtse River, starting from and returning to the river and traversing the northwest part of Hupeh, the southeast corner of Shensi and the northeast corner of Szechuen. His starting-point was Ichang, and the journey ended at Wu-shan, about 100 miles further up the Yangtse. Most of his route was through country that had not been visited by scientific explorers. The map gives many place-names, and is coloured, to show the geological features along the route. No commercial minerals were discovered excepting coal, which is of local importance.

KAMSCHATKA.—Karten von Kamtschatka. (1) Topographische Karte, from the map prepared by Mining Engineer K. J. Bogdanowitsch and Captain N. N. Leliakin, and published in 1901 on a scale of 1:840,000. (2) Geologische Karte, by Prof. Bogdanowitsch. Scale, 1:2,000,000, or 31.56 statute miles to an inch. *Petermanns Mitteilungen*, Vol. 50, No. 3. Justus Perthes, Gotha, 1904.

These maps accompany an article by Prof. Bogdanowitsch on the geology of the peninsula, which, on account of the fur, fishing, and mining interests that are beginning to develop, is attracting more attention. The topographic map is based upon the long-route surveys of the authors, and authentic materials which earlier explorers had contributed. Many elevations are indicated by figures, and numerous volcanoes

are shown from the south nearly to the north end of the peninsula. The geological map shows the rock formations along half of the west coast, and in a broad strip through the centre of the country. The places where gold, copper, iron, sulphur, and coal were discovered are indicated.

AFRICA.

NATAL.—Map of Natal showing mine department districts. Scale, 20 statute miles to an inch. Report on the Mining Industry of Natal for 1902. Pietermaritzburg, 1903.

This map supplements a very full report on the mining industry of the colony. It shows the distribution of the mineral deposits, in which respect Natal is highly favoured, and particularly in the extent of its coal measures.

MR. G. W. LITTLEHALES' GRAPHIC SOLUTION OF THE ASTRONOMICAL TRIANGLE AND SOME OF ITS VARIED APPLICATIONS TO THE PROBLEMS OF NAVIGATION.

BY

J. W. FROLEY.

A paper read before the Philosophical Society of Washington, in October, 1903, by Mr. G. W. Littlehales, entitled "A New and Abridged Method of Finding the Locus of Geographical Position and the Compass Error," outlines a work prepared by him which has for its aim the lightening of the labours of every ocean navigator adopting it. It is well known to mariners, and all others as well who have given attention to the subject, that the life of the navigator is absorbed in the tedium of arithmetical processes involving the rules of logarithms applied to the formulæ of spherical trigonometry. When his burdens and responsibilities are considered, it is needless to say that any means for rendering the task of the navigator easier is not only a boon to himself but an advance in the maritime interests of the world.

An important problem in navigation is the laying down accurately on the chart the Sumner Line of Position. It requires the accurate determination of the altitude and azimuth of a celestial body due to an estimated position of the observer. The navigator, having measured the true altitude of a celestial body and then computed the altitude and azimuth of the observed body due to the estimated geographical position of the ship, can draw a line upon his chart through this estimated geographical position of the ship at right angles to the azimuth or true bearing of the observed

celestial body, which is denominated the Sumner Line of Position by Account; and next comparing the observed true altitude with the altitude due to the estimated geographical position, he is enabled at once to draw the actual Sumner Line of Position, it being sensibly parallel to the Sumner Line of Position by Account and at a distance from it equal to the difference in minutes of arc between the observed and deduced altitudes and in a direction toward or away from the observed celestial body, according as the true altitude by observation is greater or less than the altitude computed from the estimated geographical position.

The ordinary method of deducing the required data in the foregoing problem involves the solution of the following equations:

$$\left.\begin{aligned} \sin \tfrac{^2x}{_2} &= \sin \tfrac{^2t}{_2} \cos L \cos d \sec (L-d) \\ \cos Z &= \cos (L-d) \cdot \cos x \end{aligned}\right\} \quad (1)$$

where x = an auxiliary angle,
t = the hour angle,
L = the latitude,
d = the declination,
and z = the zenith distance;

$$\sin Az = \sin t \cos d \operatorname{cosec} z \quad (2)$$

where Az = azimuth or true bearing of the observed celestial body.

An inspection of these equations shows that their solution requires the opening of the logarithmic tables ten or twelve times, and the liability of committing numerical errors is no small factor to contend with.

Mr. Littlehales has constructed a stereographic meridian projection of the celestial sphere, and made a device of it for the solution of all spherical triangles having given two sides and their included angle. The projection is 12 feet in diameter, and is overlaid with parallels and meridians; and also a series of equally-spaced concentric circumferences, and another series of equally-spaced radial lines have been drawn over it in lines of dashes. The solution of the astronomical triangle, as given by him, is as follows:

If the latitude of the observer be laid off on the bounding meridian, and the declination of the observed celestial body be laid off along the meridian making an angle with the bounding meridian equal to the hour angle of the observed celestial body, an astronomical triangle will be formed in which the known parts are respectively the co-latitude and co-declination, and their included angle, which is the hour angle of the observed body. Two of the

unknown parts of this triangle are the azimuth and the co-altitude of the observed celestial body. If this triangle is now revolved about the central point of the projection, with the side joining the latitude of the observer and the pole kept in coincidence with the bounding meridian until the position occupied by the observer reaches the pole, the former position occupied by the pole would be on the bounding meridian, and the position occupied by the observed celestial body would fall in such a position that the unknown side of the triangle representing the co-altitude would lie along some meridian, and could be measured from the graduation of the projection, and the unknown angle representing the azimuth would become an included angle between two meridians, which could likewise be measured from the graduation of the projection; and thus the altitude and the azimuth of any observed celestial body could be simultaneously determined from the diagram with a degree of precision depending only on the scale of the projection. It may be noted here that if the altitude and azimuth are given, the declination and hour angle may be determined in a very similar manner.

The projection, being 12 feet in diameter, is too large for ordinary use when kept in one continuous sheet, so Mr. Littlehales made each quadrant into about 85 overlapping sections, all conveniently indexed; and the equally-spaced concentric circumferences and the equally-spaced radial lines, all being appropriately numbered, obviate the necessity for actual revolution of the triangle. For the position of the observed body revolves into another position, which is fixed by the intersection of the circumference that the original position was on, and a radial line determined by reducing the co-latitude to minutes and adding it algebraically to the number of the radial line passing through the original position of the revolved point.

The writer, in testing this graphic method of solution, found that the same results could be obtained in about one-fifth of the time that would be required by use of the formulæ.

The method lends itself with equal facility to the determination of course and distance in great-circle sailing.

The altitude and azimuth of a star having been observed through a rift of clouds may have its identity established with facility and dispatch—first, by finding its declination and hour angle, and thence its right ascension, and, second, by reference to a star catalogue.

It is believed that this graphic method opens a way by which all mariners may practice the science of astronomical navigation, which has heretofore been restricted to those of higher education.

OBITUARY.

Sir Henry M. Stanley.

The announcement of this distinguished explorer's death had not been anticipated by the general public, though his personal friends knew that, for several months, his health had been in a very precarious condition. The end came at his home in London on the morning of May 10th, in the 63d year of his age.

Stanley's great contributions to geographical discovery are too well known to require extended recapitulation. His expedition to Lake Tanganyika (1871–72) was of value chiefly in the fact that he found Livingstone, nursed him back to better health, and gave him the supplies he needed to continue his explorations. After Livingstone's death, in 1873, Stanley determined to take up the exploration of Africa where his great predecessor had left it. Entering the continent near Zanzibar on November 12, 1874, he crossed Africa to the mouth of the Congo in 999 days, having travelled over 7,000 miles. The east and west limits of the wholly virgin field which he brought to light on this memorable journey were as far apart as New York and Omaha, and the work he did in this vast territory has stood the test of rigid scrutiny better than that of most pioneer explorers excepting those who have enjoyed thorough preliminary training for scientific research. Some critics, who complained that his work did not reach the requisite standard as to scientific quality, forgot that the pioneer explorer who traces through a continent a new route thousands of miles in length and beset with dangers cannot sit down in some small area to exhaust its scientific aspects; and yet his work is just as necessary as that of the scientific specialist who follows him.

The largest geographical results of this journey were the map of Victoria Nyanza, the material for which was obtained by a boat journey around the coasts; and the discovery and mapping of the course of the Congo from Nyangwe to the Atlantic, a distance of nearly 2,000 miles. His map of the lake has been curtailed in the northeast, where he had covered with water a part of the country of Kavirondo; he also missed the southwestern prolongation of the lake, though he discovered it on his last expedition; and many coastal details were changed by later surveys. But the map, under the circumstances, was a very creditable product, has been most

useful in our atlases, and in many respects it is still the map of the lake. His map of the course of the Congo is, in the main, that of the present day, though Grenfell, in particular, has added a large amount of detail and corrected geographical positions, the improved mapping being apparent chiefly only on maps of considerable scale.

In 1879, less than two years after Stanley first crossed Africa, he returned to the Congo under the auspices of the International Association and began his five years of incessant toil in founding stations and acquiring treaty rights from over 400 native chiefs in the large region which later became the Congo Free State. His book, *The Congo and the Founding of its Free State*, in which he told the story of these years, contains a large amount of data on soils, plants, minerals, tribes, temperatures, commercial possibilities, and other aspects of the country, and it vastly added to our knowledge of the great basin. His mapping of the Aruwimi, Kwa, Mfimi, and some other tributaries of the Congo, of Lakes Leopold II and Matumba, and of many other geographic units still stand much as he represented them on his large map, though, as is usually the case, many details have been modified by later surveys.

His expedition for the relief of Emin Pasha (1886–89), one of the most thrilling journeys ever made, resulted, geographically, in the discovery of the extent of the great forest north of the Congo, the water connection between Albert Nyanza and Lake Albert Edward, the snow-capped Ruwenzori mountain chain between the two lakes, and the southwestern prolongation of Victoria Nyanza. This expedition, the results of which are recorded in his last book of exploration, *In Darkest Africa*, ended his active career in that continent.

His work gave a very large area in Equatorial Africa to the knowledge and enterprise of the world. His contributions to the literature of Africa were far more voluminous than those of any other explorer, his efficiency as an observer of man and of nature continuously grew, and his writings are still the most prominent sources of information on the regions treated. The fact is now generally recognized that Stanley, after Livingstone, gave greater impulse than any other man to the movement which resulted in the rapid exploration of most parts of unknown Africa, and in the division of its vast territory among the European Powers.

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BOOK NOTICES.

The Philippines. A Geographical Reader. By Samuel MacClintock. 105 pp., 4 maps, and many photographic reproductions. American Book Company, New York, 1903. (Price, 40c.)

A collection of simply-told and interesting facts and descriptions relating to our new colony. The writer is the principal of the Normal School at Cebú, and his narrative gains vigour and freshness from the fact that he has seen much that he describes. In a short chapter on the present Government, Mr. MacClintock says:

> The government of the Philippines aims to secure peace and protection for all the people. It has established an excellent common school system throughout the islands, so that every person who wants an education may have it. It is building roads and bridges to afford easy passage for people and goods from place to place. It is building telegraph lines and establishing post routes, that communication may be more rapid. It is dredging rivers, cleaning out harbors, and building breakwaters for the protection of commerce. All good citizens should aid the government in every way possible. Only by so doing can peace, and justice, and happiness be secured.

Viertausend Kilometer im Ballon. By Herbert Silberer. 136 pp., and 28 illustrations from photographs. Otto Spamer, Leipzig, 1904.

Mr. Silberer, whose father organized the balloon service in the Austria–Hungarian army, has had at his disposition two fine balloons owned by the Aero Club of Vienna. With one or two companions, and sometimes alone, he has made many ascents from Vienna, usually of short duration, though he has sometimes drifted into Hungary, and was once carried over the mountains of South Germany to the plains of Prussia. He has selected twenty-nine of these voyages, since October, 1899, for description in this volume, and has illustrated them with photographs taken from the balloon. This novel feature adds much to the interest of his aerial adventures.

The photographs were taken at altitudes of from less than 100 to 4,400 metres above the earth. Some pictures of parts of Vienna taken at low elevations might serve fairly well as street plans, and have the additional advantage of showing the façades of many scores of buildings and the general aspects of the city within the field of view. A number of views of villages, with their two or three winding streets, the little church surrounded by gravestones, the groves and streams and the patchwork of tilled lands on all sides are especially effective. A picture taken at about 600 metres

shows an extensive region with villages dotted here and there and the winding roads that connect them. At the highest altitudes the aeronaut rode in the clear sky above the clouds, and his camera caught the glorious view of their upper surfaces resembling a frozen sea. The work is both unique and interesting.

Geology. By Thomas C. Chamberlin and Rollin D. Salisbury. In two volumes. Vol. I. Geologic Processes and their Results. New York, Henry Holt & Company, 1904. Pp. xx, 654. Pl. 24, Tables 3, Figs. 471. Published in the American Science Series, Advanced Course.

In this volume the authors, as a result of their long experience as instructors of geology, have departed considerably from the usual method of text-book treatment of the broad science under discussion. To quote from the preface:

> Little emphasis is laid on the commonly recognized subdivisions of the science, such as *dynamic geology*, *stratigraphic geology*, *physiographic geology*, etc. The treatment proceeds rather from the point of view that the science is a unit, that its one theme is *the history of the earth*, and that the discussions of dynamic geology, physiographic geology, etc., apart from their historical bearing, lose much of their significance and interest.

As far as possible the inductive methods of the practical geologist are made use of in the treatment of the different topics, and "the theoretical and interpretative elements which enter into the general conceptions of geology have been freely used." The effort, however, is made throughout to lead the student to "avoid confusing the interpretations based on hypothesis with the statements of fact and established doctrine," and "alternative hypothesis and alternative interpretations are frequently presented where knowledge does not warrant positive conclusions."

The book contains a wealth of new material drawn from many sources, in addition to the wide personal observations of the authors, but particularly from the publications and collections of the United States Geological Survey. It is essentially a treatise on North American geology, but this is a decided advantage in the discussion of the broad principles of the science. The development of national, state, and other geological surveys—a development with which photography as an assistant to the geologist has kept pace—has been very great during the past ten or fifteen years. Hence the new material at hand, for purposes of illustration, is extensive, and half-tone reproductions are scattered liberally through the book. The maps, thirty-eight in number, form a note-

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worthy and satisfactory feature of the book. They are from the sheets prepared by the United States Geological Survey, and are printed in three colours, like the originals.

The chapter on the Work of Running Water will be found of great interest to the general reader, on account of the discussion of many processes, the results of which are patent to the most casual observer. This chapter, together with those on the Atmosphere as a Geological Agent, and on the Work of Ground (underground) Water, the Work of Snow and Ice, and the Work of the Ocean, gives all the essentials of the modern science of physiography in succinct form and in clear demonstration. These chapters elaborate these topics more fully than is customary in text-books, because they discuss phenomena which are encountered everywhere. The common, rather than the usual phases of the phenomena, are presented on account of their greater importance, as well as their accessibility.

The chapter upon the Work of Snow and Ice is particularly full of material which has not heretofore found its way into text-books, both authors having made special studies of glaciers and glaciation for many years. Glaciers are classified as ice caps or continental glaciers, polar or high-latitude valley glaciers, Alpine valley glaciers, piedmont glaciers, cliff glaciers, and reconstructed glaciers. Piedmont glaciers are formed by the coalition of the expanded fronts of adjacent polar valley glaciers, and are exemplified by the Malaspina glacier of Alaska. Cliff glaciers are restricted to a relatively small depression in the side of a mountain or in the escarpment of a plateau. A reconstructed glacier is formed at the base of a precipice over which the ice from an ice-sheet or valley glacier has fallen. The fragments become a coherent mass through regelation, and motion may be resumed.

In explanation of the phenomena of glaciers, the authors advance the theory "that a glacier is a crystalline rock of the purest and simplest type, and that it never has other than a crystalline state. This strictly crystalline character is incompatible with viscous liquidity." A glacier is considered to be a colossal aggregation of snow crystals to flakes of much greater sizes. Snow which has lain for some time on the ground becomes granular through thawing and freezing of crystals and aggregation around crystalline centres. Increase of size of granules goes on under all conditions of atmosphere, with steady diminution in total number of granules. Large granules grow at the expense of smaller ones. In glacier ice the axes of the crystals lie at all angles to one another. The initial or

fundamental cause of glacial motion must be operative at the heads of the glaciers where the temperature is lowest and the material is most loosely granular. Movement of the mass takes place by the minute individual movements of the grains upon one another, and flowage is facilitated by the probable momentary liquefaction of minute portions of the mass under the influence of compression. The ice as a whole, however, remains rigid; it does not have the slow, viscous fluidity of asphalt or lava. Near the end or edge of a glacier there is a co-operation of rigid thrust from behind, with the tendency of the mass to move on its own account. This tendency is controlled by gravity, and conforms in its results to the laws of liquid flow.

The theory of the crystalline character of glaciers seems to offer a satisfactory explanation of the enormous amount of scouring, grooving, and planing that has been done by glaciers. If glacier ice were really viscous, its hold over imbedded débris should be viscous too, and a boulder in the bottom would roll over the rocky bed instead of grinding into it, as often has been done. According to the new theory, however, stones in the base of the glacier would be held with great rigidity when the ice is dry, scoring the bottom with vigour, while they might be rotated with ease when the ice was wet. This view, too, would explain crevasses and other evidences of brittleness and movement on upward slopes even when the upper as well as the lower surface is inclined backward.

In the chapter on the Origin and Descent of Rocks, an epitome is given of petrology in which the results of the latest researches in this difficult branch of study are applied to old topics. Rocks of igneous origin are broadly separated into pyroclastics, the glassy rocks or obsidians, the porphyritic rocks or porphyries, and the phanero-crystalline rocks or phanerites. The newly-proposed system of classification and nomenclature advanced by Cross, Iddings, Pirsson, and Washington is briefly and clearly reviewed. A feature of this new classification, which appeals to student and reader alike, is the definition and limitation of some familiar rock-names so that they have certain broad, generalized meanings. The names which thus become of wider significance than heretofore for convenience in field work are granite, syenite, diorite, gabbro, dolerite, peridotite, pyroxenite, and hornblendite. The new and more rigorous system, which is designed to meet the needs of the professional petrologist, is dependent upon quantitative chemical characteristics, and all igneous rocks are classified primarily according to

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chemical composition, and only secondarily according to mineral constituents, texture, and other characters. The old separation into plutonics and volcanics as a fundamental differentiation is entirely abandoned, the American school of petrology, at least, no longer thinking that an igneous rock should receive different names and be assigned to two or more systematic positions on account of fortuitous circumstances of solidification.

One looks with especial eagerness for the discussion of the various theories which have been advanced to account for the origin of the earth. The full discussion of the accretion or "planetissimal" theory is to come in the second volume, but an outline of the hypothesis is given in the section of the present volume on the distribution of heat. The senior author is the originator of this new theory, which supposes that

> the earth was built up gradually by the infall of matter, bit by bit, at such a rate that though each little mass became hot as a result of its fall, it cooled off before others fell on the same spot, the rain of matter not being fast enough to heat up the whole mass to the melting point,

and that

> the internal heat was gradually developed from the centre outwards as the earth grew and the internal compression (due to gravity) was progressively developed.

Two other hypotheses are stated, and the respects in which they fail of explaining known phenomena are pointed out. Both depend upon the idea, commonly known as the Nebular Hypothesis of Laplace, that the earth has passed through gaseous and liquid conditions to a solid state, one school holding that the solidification proceeded from the exterior inward by reason of uniform cooling, due to convection, while the other school contends that pressure caused solidification at the centre first, in spite of the high temperature. The latter view excludes transfer of heat by convection between different zones, beginning with the centre as soon as solidification or prohibitive viscosity obtained.

The accretion hypothesis supposes the earth to be of variable composition on account of presumable variation in the nature of the infalling bodies making up the globe. Chemical and physical recombination would be slow in progress. Volcanic action would transfer large amounts of heat as well as material from inner zones to outer ones, and even to the surface—a process which still continues, though less actively than in earlier ages. Liquid matter is thus supposed to be forced outwards or extended as soon as formed, and to continue to form and to rise until the temperature of the region affected is adjusted again to the conditions producing solid-

ity. Shrinkage affects all zones, and may even originate in the deeper. Double distortional effects result. On account of the thick segments concerned, stresses may accumulate, and thus bring about extensive movements after long periods of rest.

The difficulties in the path of the modern vulcanologist are clearly indicated in the discussion of six theories which have been advanced to account for the origin of lavas and forces which expel them. After a succinct statement of the theories and of the objections to them, the authors briefly outline the explanation of the phenomena of vulcanism according to the accretion hypothesis, leaving the full treatment of the subject for the second volume. Water is evidently one of the most powerful agents in an explosive eruption, but, according to the new theory, the chief source of this substance is the deep interior, and not the surface. In fact, the volcanic gases (including steam) are additions to the atmosphere and the hydrosphere. The general force of extrusion is considered to lie in deep-seated periodic and other stresses, and the slow pressure, due to creep of the rock adjacent, to the supposed slender threads of liquid rock. The frequent pauses in action are assigned to temporary deficiencies of supply; the renewals to the gathering of new supplies after a sufficient period of accumulation.

The concluding chapter of the volume is devoted to a presentation of the geologic functions of life, and may be considered introductory to Volume II, which is to treat of historical geology. The discussion here of the contributions to the rocks made by the different classes of plants and animals will be found highly suggestive.

The book is well printed on heavy-coated paper. The paper makes it ponderous, and the highly-glazed surface is somewhat trying to the eyes, unless the angle at which the light comes in is just right, but the resulting excellent character of the abundant halftone illustrations is a compensating advantage. The volume is a welcome addition to the series of treatises upon geologic science, and its clear, succinct, interesting style commends it most highly to the general reader as well as to the student and professional geologist.

E. O. H.

The Expansion of Russia, 1815–1900. By Francis Henry Skrine. viii and 386 pp., Index, and 3 maps. The University Press, Cambridge, England.

This volume appears in the Cambridge Historical Series, whose aim is to facilitate the work of those who desire to understand the existing political conditions in the various States of modern Europe.

Mr. Skrine sets forth, in clear light, the forces that have been in play to build up the vast dominion of Russia and to produce the social and political conditions which now exist. While he counts autocracy as the most potent factor in the development of the empire, he, of course, includes geographical environment as among the determining influences. He shows the isolation which for generations cut Russia off from the currents of modern life, depicts the Caucasus as the lofty chain that long called a halt in the migration of the human race westward, and describes the distribution of resources. The maps show the lines of Russian advance in the Caucasus and Central Asia, and the Balkan Peninsula and the Russian Empire of 1900. The topic is a large one; but it is condensed with lucidity, and is a vivid account of the influences and events that have been shaping the history of Russia.

Der Paraguay-Tee (Yerba Mate). By Prof. Dr. F. W. Neger and Dr. L. Vanino. 56 pp., 22 illustrations, and a Bibliography. Fr. Grub. Stuttgart, 1903. Price (paper), 2 m.

This is a scientific study of a plant that, for unknown ages, has been used in the decoction of a beverage somewhat resembling Chinese tea. Its use is very widely spread in South America. The authors say that the Spanish name of the plant is Yerba Mate, not Maté, as it is commonly written. Proof has been found that the plant was in use in the days of the Peruvian Incas, probably 1,000 years ago. The beverage is now found in every house or hut in the southeast quarter of South America, and merchants are trying to introduce it into Europe, and particularly into Germany. The book gives the history of the plant as far as it is known, describes the different varieties, devotes a chapter to its chemistry, treats of the methods of collecting and cultivating it, establishes its growing importance as a commercial product, and concludes with a bibliography. It is an able, authoritative, and interesting treatment of this important economic plant.

Uganda. By Julius Richter. vii and 268 pp. C. Bertelsmann. Gütersloh, 1893. (Price, 3 marks)

This is a German contribution to the history of evangelical missions and colonial policy in Central Africa. It tells the story of Uganda and its kings and people and then takes up the history of the missions from the time of Stanley's famous appeal through subsequent days of sunshine, anxiety, and tragedy to 1892. The book summarizes for German readers some of the most remarkable and finally fruitful of missionary enterprises.

Die Wege und Entfernungen zur See im Welt-Verkehr. By Dr. R. Jannasch. 17 tables and map of the world. Published by "Export." Berlin, 1904. (*Price, 3 marks.*)

The tables in this book give a vast amount of information with regard to ocean trade routes and the distances by sea between all ports of importance. If we turn, for example, to "New York" in the index we are referred to pages on which are printed twelve tables giving the distances between New York and ports on all the oceans, and sometimes in relation to various routes, as *via* the Suez Canal or the Cape. The distances are given in nautical miles, which may be converted into statute miles, if desired, by multiplying the figures by 1.15. The accompanying map is large enough to show practically all the deep-sea routes, with the distances from port to port. This useful compilation would have saved some writers in the past few years many hours of labour, and it will be a time-saving reference book in counting houses and many other places.

Pitman's German Commercial Reader. 208 pp., 3 maps, and a German–English vocabulary. Sir Isaac Pitman & Sons. London and New York. (*Price, 85c.*)

Pitman's French Commercial Reader. 214 pp., maps and other illustrations and a French–English vocabulary. Sir Isaac Pitman & Sons. London and New York. (*Price, 85c.*)

These books, intended for students in commercial courses, give an insight into the methods of business and of business correspondence in Germany and France respectively. Their vocabularies are designed to familiarize the student with the words commonly used in the commercial intercourse of those countries. The German book has a short commercial geography of Germany, a history of commerce, articles on all the leading branches of German trade, together with the lives of a number of famous men of business. The French book is written practically on the same lines. Students who have had about two years' training in German and French will be able to use these books to good advantage.

Old Cape Colony. A Chronicle of her Men and Houses from 1625 to 1806. By Mrs. A. P. Trotter. 320 pp., numerous illustrations, and Index. A. Constable & Co., Ltd., London, 1903.

The author was much interested in the history of the oldest farms of Cape Colony, of the earliest settlers, of the men who made the laws, and of the gabled houses that sheltered the pioneers. She

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went on bicycle trips to sketch the still existing memorials of the early days, and searched the archives for material. The result is a book full of sketches reproducing picturesque bits from the architecture, handiwork, and other aspects of the olden time, besides a number of portraits of the old worthies themselves. The letterpress in which these sketches are set has much antiquarian and historical value and carries a vivid human interest, for it deals with the men and women who helped to fashion the destinies of a great colony.

Thirty Seasons in Scandinavia. By E. B. Kennedy. lx and 278 pp., and 20 half-tone illustrations. Edward Arnold, London; and Longmans, Green & Co., New York, 1903. (Price, $3.80 net; $4 by mail.)

Mr. Kennedy was attracted to the solitudes of the Norwegian fiords and the great Scandinavian uplands by the advantages they offer to the man who loves to spend his vacations with rod, rifle, or gun in hand. He found that the arts of the angler and the Nimrod may be practiced there with the keenest zest and delight, and the result is that for thirty-one consecutive seasons he has wandered for many weeks along the seaboard and in the far interior. He has had rich experiences in roughing it through the great peninsula; and having an eye for the beautiful and the tastes both of the naturalist and the sportsman, he has filled his pages with a large variety of interesting description and information, bringing us into closer touch with the phases of nature that are most characteristic of the country. The book has also considerable geographical interest of the popular sort. The author speaks of the Jostedal Glacier as covered with perpetual snow and the largest and finest in Europe:

> This gigantic octopus shoots its twenty-four icy tentacles into the valleys which form its boundaries. Its length is about sixty English miles and area about 500 square miles.

Sporting camps, the salmon and trouting streams, lemmings, reindeer, beavers, and other beasts and birds, ski travel, winter sports, and the condition of the peasantry are among the many topics of the volume.

In Russian Turkestan. By Annette M. B. Meakin. xvii and 316 pp., 16 full-page illustrations, a map, and Index. George Allen, London, 1903. (Price, 7s. 6d.)

The writer, whose earlier travels and studies were an excellent preparative for this journey and its literary results, does not dilate,

like many travellers, upon her personal experiences, but condenses what she saw and learned in Turkestan into a most interesting account of the country and its people. She has thus made a book that ranks above the ordinary works of travel; and the volume has a place of its own in the literature of Russian Turkestan, because probably no other book equals it as an intimate study of some phases of the people, and especially of the women and the household life of that region. The author describes the Sarts, their management of the precious water which creates the oases they occupy, their trees and remarkable fruits, and their great cotton, silk, and other industries. She describes the native and the Russian methods of government, and the building of Sart towns and their characteristics. We realize why the natives are called the strictest Mohammedans in the world, and recognize the fanaticism which made their land forbidden to all unbelievers until the Russians forced their domination upon the people. There are chapters on Sart colleges and schools, the women and children, marriage, cookery, and other aspects of the people, with all their blessings and ills. In Part II the political divisions and chief cities are described in greater detail, and the Kirghis and Tekke Turkomans are treated in two interesting chapters. Some of the photographs are unique, and no one but a woman would have been permitted to take them. They deal with the inner life of the people, and some of them show the women and their young families in the rooms or courts of their houses. The book is full of information, vividly presented and never flagging in interest; and it illustrates the fact that women with acute and accurate powers of observation enjoy some advantages for the description of a new country and its people that are not within the reach of the other sex.

Australia, Our Colonies, and Other Islands of the Sea. By Frank G. Carpenter. 388 pp., 9 maps and many half-tone illustrations, and Index. American Book Company, New York, 1904. (*Price, 60c.*)

This is the latest of Mr. Carpenter's geographical readers. It embraces the smallest of the continents and the chief islands in every sea. It is attractive, with its many maps, pictures, and engaging letterpress. But why cannot geographical readers be made just as interesting and yet of a rather more solid and edifying character? Mr. Carpenter says something about sulphur in Sicily, but we get no idea from his remarks that Sicily is linked with every nation that uses much sulphur, because it is the greatest source of the world-supply. Children would be interested in the reason why

population tends more to the north than to the south coast of Sicily. They would understand and would not forget it. This suggestion is not meant especially to apply to Mr. Carpenter's book, but it would seem as if some writers whose studies have familiarised them with illustrations of the correlations of man and his geographical environment might produce books for school children more interesting and more suggestive and mentally stimulating than the average geographical reader.

Korea. By August Hamilton. With map and 8 illustrations. Charles Scribner's Sons, New York, 1904.

This book is a very timely product of the press. Korea is in the unfortunate position of a helpless neutral between two powerful nations at war, and her soil has already become the scene of their military manœuvres and a part of their battleground. A book, such as this one, which gives to the reader a clearer conception of the geography of the coasts and of the interior, the nature of the ports and communications, the characteristics and importance of the larger towns, than is to be found in earlier works, even though the descriptions are condensed, is an especially useful contribution at this time. None of the preceding books on Korea gives so much information about the region between Pyöng-yang (Ping-yang) and the lower Yalu, where the Russian and Japanese land forces have first confronted one another, as is to be found in this volume. While the book is chiefly confined to a review of Korea in all the aspects of its people, industries, and commerce, an introductory chapter of 43 pages deals with the position of Manchuria, the military and naval strength of Russia and Japan, and the Japanese naval stations.

The writer says that, notwithstanding the past survey work of the Japanese on the coasts of Korea, there is still little knowledge of the numerous islands and archipelagoes, shoals and reefs, which make its shores the terror of all mariners. The Korean Government in 1903 requested the Japanese Government to make a survey of the peninsula. At the beginning of the present war this work was in progress and the outlining of its coasts had been completed.

Führer in das Höhlengebiet von Brünn. By Prof. A. Makowsky and Prof. A. Rzehak. 48 pp., a map, 17 photographs and diagrams, and profiles of underground passages. Carl Winiker, Brünn, Austria, 1903. (Price, 1 k. 20.)

A little way to the northeast of the City of Brünn are low lime-

stone mountains in which are found twelve caves and grottos, most of them interesting, and some of them more than commonly attractive. Brünn is the convenient point of departure for those who wish to visit these picturesque mountains and their fine caves; and this little book tells how they may be reached, and gives many facts about them that are not only interesting but are also of scientific quality. In some of the caves are remains of fossil animals, and particularly of the extinct cave bear, but the best specimens, naturally, have been taken to the museum at Vienna.

Geologischer Führer durch Bosnien und die Hercegovina. By Dr. Friedrich Katzer, Government Geologist. 280 pp., 8 maps, 64 illustrations, and Index. The Government, Sarajevo, Bosnia, 1903.

This attractively-produced and authoritative little work was especially prepared for the Ninth International Geological Congress at Vienna last fall, whose programme included an excursion through Bosnia and Herzegovina, where the members had an opportunity to enjoy the scenic beauty of these regions and witness their remarkable development since the influence of Austria–Hungary became predominant. The book was prepared to facilitate the efforts of the members in their attention to the geology of the provinces traversed. After a short review of the subject the geological conditions along the extensive routes followed by the excursionists in September last are described in greater detail. Besides a map of the rail and wagon routes there are seven others, which are excellent specimens, showing the rock formations of more or less extended areas visited. The illustrations include many picturesque photographs and geological profiles. The book is an addition to the rather limited scientific literature relating to these provinces.

L'Évolution Comparée des Sables, par Jules Girard. Pp. 121, pl. XII, 40 figs. in text. Large 8vo. Paris, F. R. de Rudeval, 1903.

In this essay the author has collected observations from a wide range of literature, and has combined them with extensive personal observations into a valuable and interesting compend of the geographical action of sands under all conditions. The subject is considered under four heads: erosion, meteoric abrasion, dunes, and alteration of coast-lines. The article well repays careful reading, and the abundant references give an admirable review of current literature, and indicate a surprising number of investigations of a subject that at first thought seems rather narrow in scope.

Erosion.—Of the three products of the decomposition of rocks, namely: sands, muds, and carbonate of lime, sands are the most important agents of erosion. The erosive work of the atmosphere is greatly affected by the amount of rainfall, and the amount of rainfall varies according to the altitude, increasing on an average 1 cm. for every 10 m. of elevation. The average rainfall for the plains of Europe is estimated at 575 mm. per year; while for the mountainous regions it is 1,300 mm. On the plains, forests have the effect of increasing the rainfall, but of retarding the erosion. Sands, furthermore, have been and are the powerful tools of abrasion under the pressure of glacial ice.

The underground circulation of water sometimes produces important surface changes, especially where beds of sand rest on impermeable rocks. Landslides and small movements of the ground are numerous. Quicksands result from water impregnating a bed of sand composed of pure and fine grains of quartz. The unstable, flowing condition of the sands results when the bed contains not less than 20% by weight of water thoroughly mixed with the sand. Disastrous mud-flows have resulted from the soaking of beds of silt with excess of water.

Meteoric Abrasion.—Meteoric abrasion is much influenced by the thermal conditions of the atmosphere. The most favourable regions for such abrasion are deserts and arid or semi-arid districts. Wind-driven sands have carved the granites of the desert of the Gobi, the sandstones of the deserts of Africa, the sandstones of Monument Park, Colorado, and other portions of the Rocky Mountains into forms which are typical of all arid regions where the rocks are of varying degrees of hardness. The progressive desiccation of some regions, that of the basin of the Caspian, for example, is partly due to the wind-driven sands filling lakes or depressions where water has gathered. Where arms of the sea have been shut off by the driven sands, extensive salt deposits have been made, as along the Isthmus of Suez.

The musical sands of the peninsula of Sinai, the desert of Peru, and elsewhere are due to the surface drying of clean sands and the gliding of the top layers over those beneath. Floating sands have been observed in many parts of the world—a phenomenon which is due to the adhesion of minute bubbles of air to the particles of dry sand blown out upon the surface of the water.

The rapid changes of temperature upon the barren expanses of a sandy desert produce terrible wind-storms. In these storms, upon a region like the Sahara, the wind sometimes attains a velocity

of 30 m. per second—sufficient to raise vast quantities of sand and transport them from place to place. The whirlwinds accompanying the tempests raise the sand in columns, and sometimes several of these funnel-shaped columns are to be seen traversing the desert at once. The clouds of dust driven before the winds are terrible features of a journey through such regions. The finest dust remains in suspension in the atmosphere for days, and is transported in vast quantities from the Sahara to the south of Europe. The air to the westward of Africa is likewise loaded at times with fine dust. The map (Plate III) shows the distribution in time and place throughout Eurasia of noteworthy dust-storms. The sand driven by these winds is a powerful agent of abrasion.

The study of the vast deposits of loess in the valley of the Hoang-Ho, the Mississippi, and elsewhere has led most observers to the conclusion that it is a result of eolian action or of eolian combined with river action, although there has been, and still is, much discussion of the subject. The author seems to incline to a purely atmospheric origin for these peculiar deposits.

Dunes.—In the chapter on dunes the author discusses first the mode of formation. Scientific observation upon the accumulation of the sands is recent and the terminology defective, although the Sahara and other deserts and the dunes of the sea-coast have long received some notice. The form and direction of dunes are dependent upon the force and velocity of the winds. In some cases it has been possible to make an artificial section of a dune which has given an indication of the intensity and direction of the ancient currents of air. The intensity of the wind is the primary cause of the transportation of sand, but the direction of the prevailing winds, the dryness of the atmosphere, and the composition of the soil are factors which enter into the formation of dunes. Their height is as variable as the causes which lead to their formation. The highest dune of the coasts of France is 158 m.; while in Tunis some are known which exceed 200 m. in altitude, and in the Great Sahara there are some which are much higher.

The observations which have been carried on at the Grand Erg show that the humidity of the sub-soil has much to do with the location of a dune; even a slight degree of humidity causes the grains to adhere and to resist the action of the wind, thus forming a favourable spot for an accumulation. Capillarity, too, has had its effect in distributing the humidity of the soil. The mounds of sand form reservoirs of water, increasing humidity near their bases, and thus favouring vegetation on their lower slopes. This principle

of the agglomeration of the sands by humidity cannot, however, be extended to all regions of dunes. The term "erg" is of topographic use throughout the Sahara to designate a sandy region, large or small, flat or undulating, covered with dunes or traversed by hills. The Grand Erg comprises an area of about 47,000 square miles, in which there is a perfect wilderness of chains of dunes. The large dunes of the region show a considerable relative degree of stability.

The form of dunes varies according to the character of the winds. Where whirlwinds prevail the forms are irregular. Where the direction of the wind is constant the side of impact is abrupt, while the opposite side shows a more gentle slope. Throughout the Grand Erg, the elongated cirque, with four summits, two principal cols and two secondary points, is a characteristic form. One such star-shaped dune attains an altitude of 523 m. Pure sands, without mixture of earthy dust, form elongated dunes, with semicircular concave heads toward the direction from which the prevailing wind comes.

The author describes the effect of vegetation in arresting the migration of dunes, and gives a list of five plants—*Arundo arenaria*, *Hierochloa utriculata*, *Ammophila arenaria*, *Elymus arenarius*, and *Panicum amarum*—which have been used with good effect in France, Chili, and Massachusetts, and describes the woven barriers which have been used in Northern Germany for the same purpose.

The Alteration of Shore-lines.—Beginning with the origin of sea-beaches through breaking up of rocks and the formation of gravel and sand through the action of waves, the author considers the formations from coarse above to fine below, grading out to the edge of the continental shelf, where the deep-sea deposits of ooze begin. The inclination of the surface of a beach never exceeds 41°; while along the coast of Belgium slopes have been measured which are as low as 3 or 4 mm. to the metre for long distances. The formation of ripple-marks follows the laws of wave motion, and the interference of two systems of waves produces the somewhat angular sandpockets where the configuration of the shore concentrates the motion. The sand banks near the mouth of the Gironde River have been mapped and studied with care for two centuries. Plate VIII shows some of the remarkable changes of shore-line which have taken place during the period. The Peninsula of Médoc is being gradually destroyed, and the opposite bank of the river is being correspondingly extended.

The coasts and islands of the North Sea furnish instructive examples of the constant changes taking place along sandy shores.

Cape Sable Island and Cape Canaveral are cited among the many sandy islands and points along the Atlantic coast of North America as showing the constant alteration resulting from the action of winds, waves, and currents. In this connection the important matter of the formation of offshore bars and barrier islands is illustrated by descriptions and maps of typical localities on the Black Sea, Sea of Azov, Baltic Sea, Arctic Ocean, and elsewhere.

The distribution of materials brought down by rivers is typified on a large scale by the action of the Mississippi, which is extending its delta at the rate of 8 km. in a century. The action of the rivers of the west of France, especially the Gironde and the Loire, is given more in detail. The Gironde receives from the Garonne and the Dordogne and distributes along the seacoast about 5,000,000 cubic metres of sandy mud per annum, or an average of 13,700 cubic metres per day. This material and that from the Loire have greatly changed the coast within historic times. The prevailing currents set from south to north along the coast. Bocage, La Rochelle, and other flourishing ports of earlier times are now far from the sea; while the ancient bay of Poitou is now a marsh.

The Rhone carries into the Mediterranean 17,000,000 cubic metres of sand and mud per year, or 2,000 cubic metres per hour. Plate XII shows the changes which have been wrought within historic times by the deposition of this sediment. The author notes also the transformation which has taken place at the mouths of the Tiber, the Po, and the Nile. In all cases the lakes formed in the deltas by the changes of the river-bed are an important feature of the development.

Accepting the general continental shore-lines as being determined by fracture lines of the lithosphere, rocky coasts appear as the ancient coasts and the alluvial plains as the new. The coast of Maine has given Gulliver the opportunity of working out "cycles and epicycles" of erosion. Elevated beaches showing former extension of the sea are very common. The "sand åsars" of Sweden, which are elongated ridges of sand, are held by some observers to mark the courses of ancient glacial torrents.

The shores of the English Channel and the coast of Holland have been studied for many years, and the changes therein have been mapped with care. The French shore of the Channel has furnished much sand to the coast of Belgium and Holland. The general opinion that the coast of Belgium has been essentially modified during the past century has been proved incorrect. The coast of Holland, on the other hand, has changed considerably through the

artificial introduction of two disturbing elements—the cutting of the ship canal from Rotterdam across the Hook of Holland to the sea and the construction of the port of Ijmuiden at the ocean end of the canal. The jetties at Ijmuiden have caused the deposition of a triangular area of sand extending 3 km. alongshore and 450 m. into the sea. In general, during the past half century the sea has gained upon the land, cutting into the dunes and increasing the slope of the beaches.

The effects of a single great storm may be very extensive. The tempest of December, 1894, caused the highest tide known in a hundred years. The dunes at Scheveningen were partly washed away; the stone facing of the great dike of the Helder was torn up over an area of 5,000 square metres. Toward the north certain lines of dunes were entirely washed away. At Callanstoog the sea burst through the dunes and inundated a large area.

E. O. H.

NOTES AND NEWS.

EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS.—The summer vacation being near at hand, it is thought well to remind the Fellows that this Society will entertain the foreign delegates to the Congress at a dinner on the 14th of September, and that tickets may be secured in advance by those who desire to be present on that occasion.

It is hoped that many of the Fellows will arrange to take part in the steamboat excursion to Fishkill on the 15th of September.

THE PERMANENT INTERNATIONAL ASSOCIATION OF NAVIGATION CONGRESSES publishes Papers, Proceedings, and other documents.

Permanent Members pay a yearly subscription of 10 francs (8 shillings, or 2 dollars).

Temporary Members pay a subscription of 25 francs (£1, or $5).

The Offices are at 38 Rue de Louvain, Brussels, Belgium. The Office of the Members representing the United States by appointment of the State Department is in the Army Building, 39 Whitehall Street, New York. These representatives are: Col. C. W. Raymond, U. S. A.; Maj. H. F. Hodges, U. S. A.; Maj. J. C. Sanford, U. S. A.; E. L. Corthell, C. E., John Bogart, C. E.

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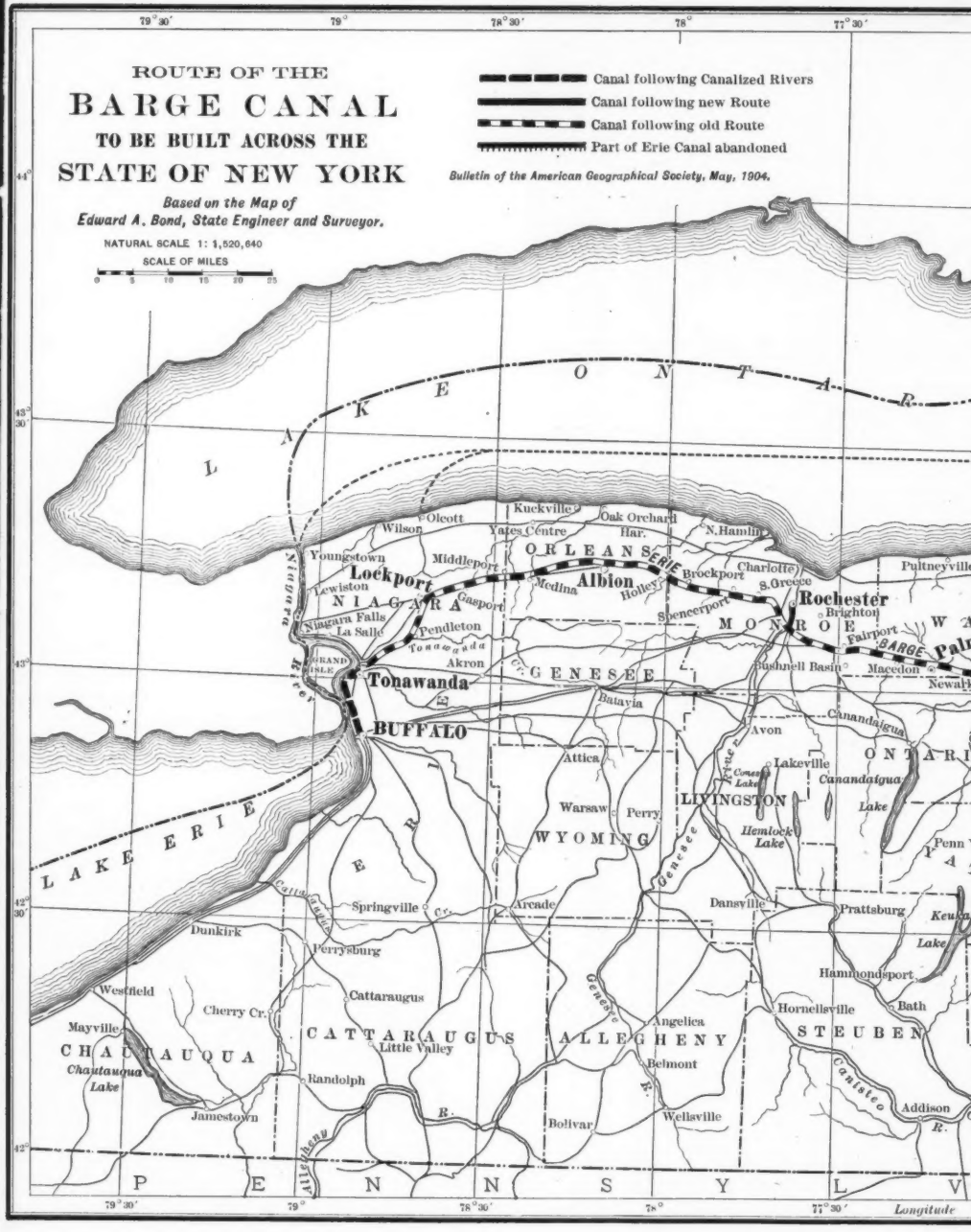
ROUTE OF THE
BARGE CANAL
TO BE BUILT ACROSS THE
STATE OF NEW YORK
Based on the Map of
Edward A. Bond, State Engineer and Surveyor.
NATURAL SCALE 1: 1,520,640
SCALE OF MILES
Canal following Canalized Rivers
Canal following new Route
Canal following old Route
Part of Erie Canal abandoned
Bulletin of the American Geographical Society, May, 1904.
79° 30′
79°
78° 30′
78°
77° 30′
44°
43° 30′
43°
42° 30′
42°
ONTARIO
LAKE ERIE
Niagara R.
Lockport
Lewiston
NIAGARA
Youngstown
Niagara Falls
La Salle
Pendleton
GRAND ISLE
Tonawanda
BUFFALO
Olcott
Wilson
Kuckville
Oak Orchard Har.
Yates Centre
N. Hamlin
ORLEANS
Middleport
Medina
Albion
Holley
Brockport
Charlotte
S. Greece
Pultneyville
ERIE
Gasport
Akron
Spencerport
Rochester
Brighton
MONROE
Fairport
BARGE
Bushnell Basin
Macedon
Newark
GENESEE
Batavia
Canandaigua
Avon
Attica
Lakeville
Conesus Lake
Canandaigua Lake
ONTARIO
LIVINGSTON
Warsaw
Perry
WYOMING
Hemlock Lake
Genesee R.
Springville
Arcade
Dansville
Prattsburg
Keuka Lake
Dunkirk
Perrysburg
Hammondsport
Westfield
Cattaraugus
Cherry Cr.
Hornellsville
Bath
Mayville
CHAUTAUQUA
CATTARAUGUS
Little Valley
ALLEGHENY
Angelica
STEUBEN
Chautauqua Lake
Randolph
Belmont
Canisteo R.
Addison
Jamestown
Bolivar
Wellsville
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PENNSYLVANIA
79° 30′
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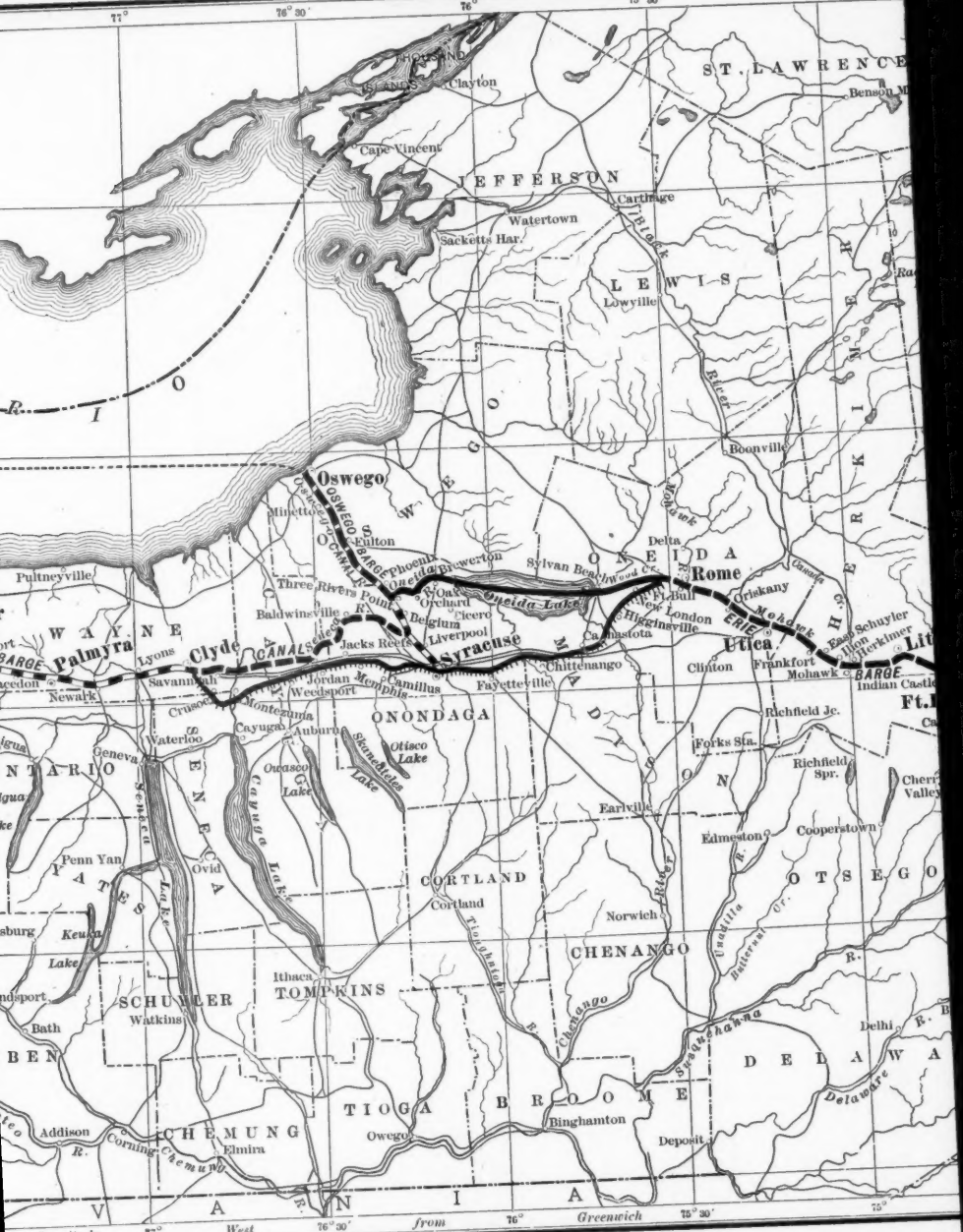
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JEFFERSON
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Watertown
Sacketts Har.
LEWIS
Lowville
Black R.
Moose R.
Boonville
Oswego
Oswego Canal
Oswego Barge Canal
Minetto
Fulton
Phoenix
Brewerton
Sylvan Beach
Wood Cr.
ONEIDA
Rome
Delta
Canada Cr.
Pulneyville
Three Rivers Point
Oneida R.
Oneida Lake
Oak Orchard
Cicero
Ft. Bull
Oriskany
Baldwinsville
Seneca R.
Belgium
Liverpool
London
Higginsville
Erie Canal
Mohawk R.
East Schuyler
Ilion
Herkimer
WAYNE
Palmyra
Lyons
Clyde
Barge Canals
Jacks Reefs
Syracuse
Camillus
Camastota
Utica
Clinton
Frankfort
Mohawk
Barge Canal
Indian Castle
Ft.
Savannah
Jordan
Memphis
Weedsport
Fayetteville
Chittenango
Newark
Crusoe
Montezuma
ONONDAGA
Richfield Jc.
Waterloo
Cayuga
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Skaneateles Lake
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Seneca R.
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Earlville
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Ovid
Edmeston
Cooperstown
YATES
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Norwich
Keuka Lake
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CHENANGO
SCHUYLER
TOMPKINS
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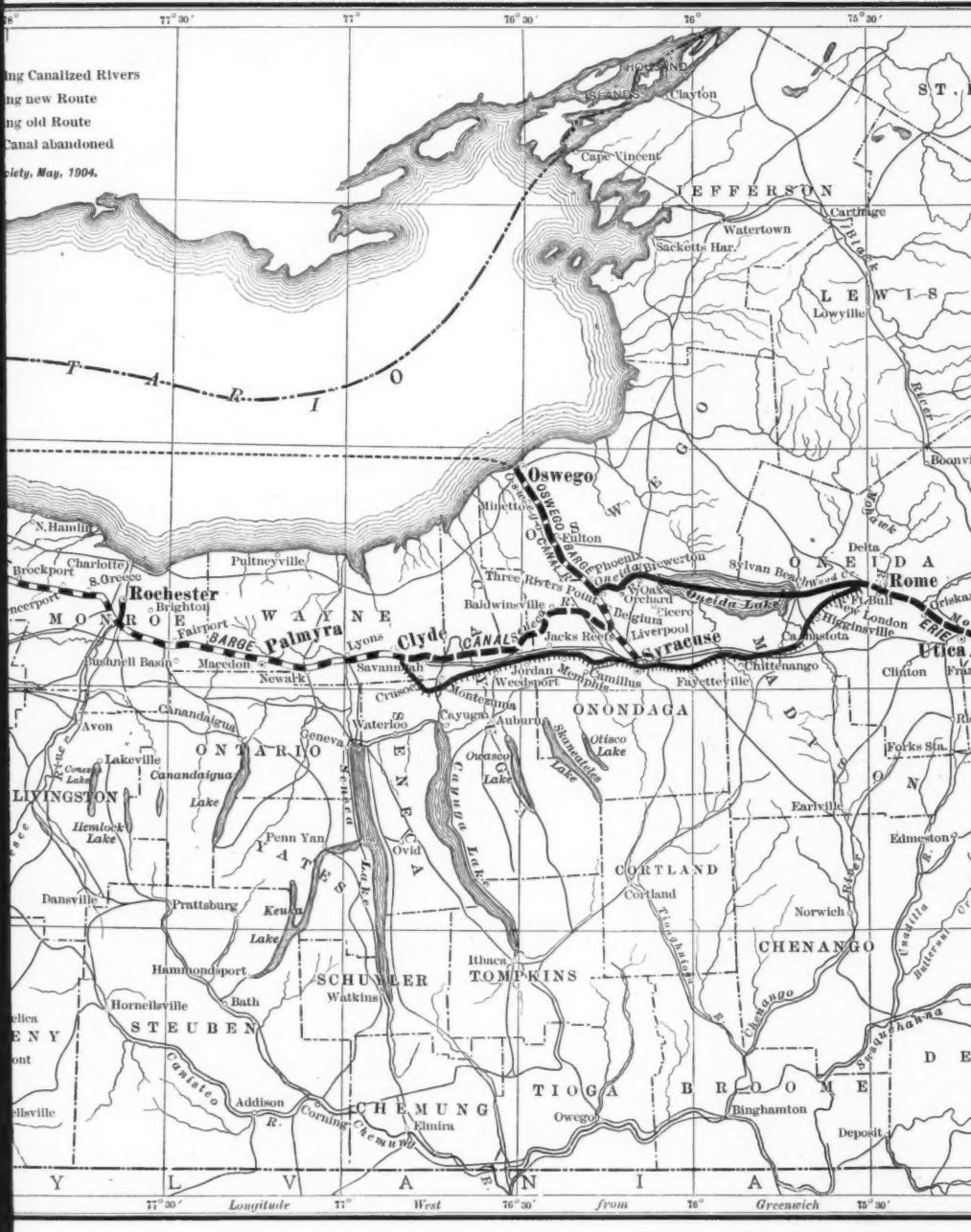
DELAWARE
TIOGA
BROOME
Binghamton
Addison
Corning
Chemung R.
CHEMUNG
Elmira
Owego
Deposit
Susquehanna R.
Delaware R.
PENNSYLVANIA
Longitude
77° West
76° 30'
from
76° Greenwich
75° 30'
75°


ing Canalized Rivers
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Canal abandoned
ciety, May, 1904.
77° 30′
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Pulaski
Oriskany
N. Hamlin
Brockport
Charlotte
S. Greece
Rochester
Pultneyville
Brighton
MONROE
WAYNE
Fairport
BARGE
Palmyra
Lyons
Clyde
CANAL
Baldwinsville
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Ft. Bull
New London
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Utica
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Bushnell Basin
Macedon
Newark
Savannah
Jordan
Weedsport
Memphis
Crusoe
Montezuma
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Owasco Lake
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Waterloo
Geneva
Seneca Lake
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Lakeville
ONTARIO
LIVINGSTON
Hemlock Lake
Penn Yan
YATES
Ovid
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Dansville
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from
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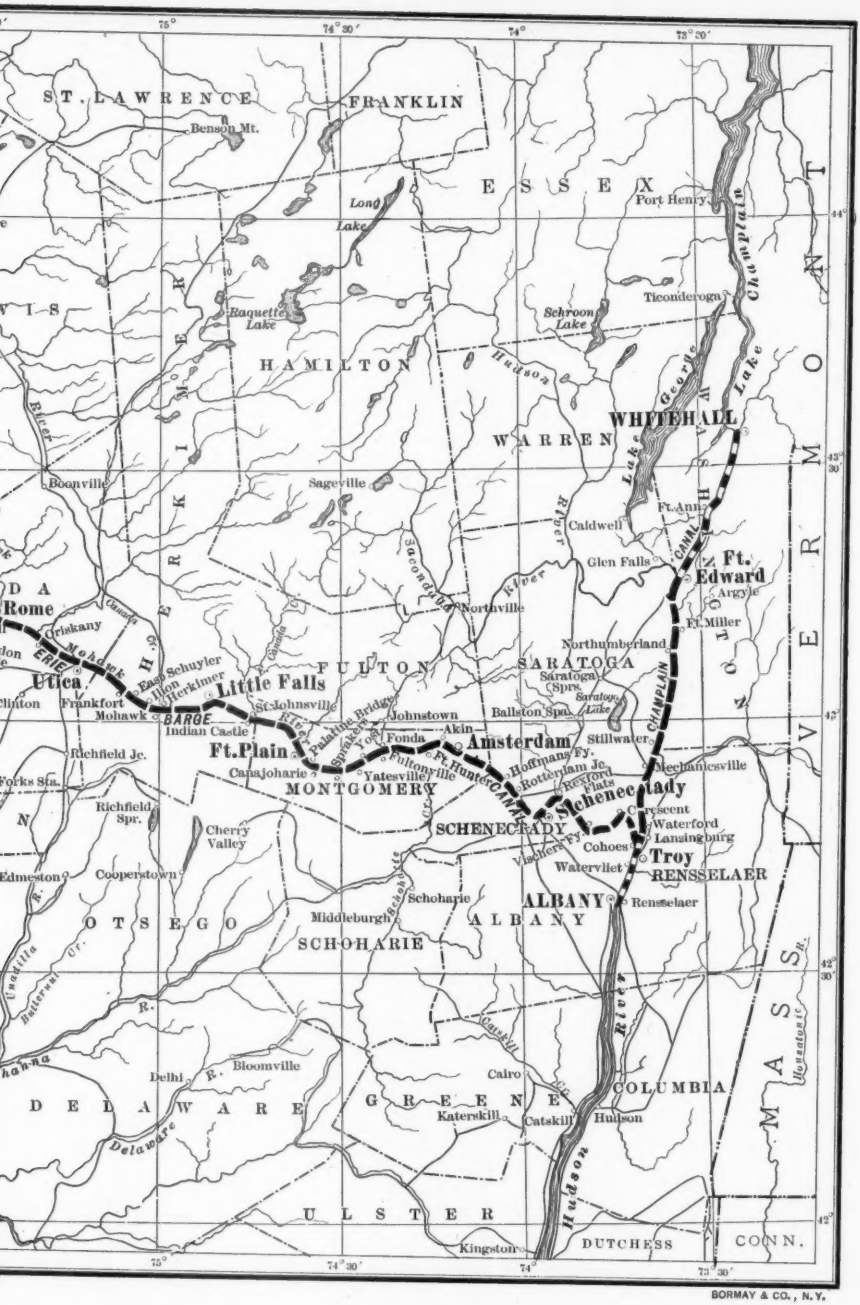
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Lake Champlain
Ticonderoga
Schroon Lake
Raquette Lake
HAMILTON
Hudson
WHITEHALL
WARREN
Lake George
Boonville
Sageville
Caldwell
Ft. Ann
CANAL
Ft. Edward
Glen Falls
Argyle
Rome
Oriskany
Mohawk
ERIE
BARGE
Northville
Ft. Miller
Northumberland
Utica
Little Falls
FULTON
SARATOGA
Saratoga Spgs.
Saratoga Lake
CHAMPLAIN
Frankfort
St. Johnsville
Johnstown
Ballston Spa
Indian Castle
Fonda
Akin
Amsterdam
Stillwater
Ft. Plain
Canajoharie
Yatesville
Fultonville
Ft. Hunter
Hoffmans Fy.
Rotterdam Jc.
Rexford Flats
Mechanicsville
Schenectady
MONTGOMERY
Richfield Jc.
Richfield Spr.
Cherry Valley
SCHENECTADY
Crescent
Waterford
Lansingburg
Cohoes
Troy
Watervliet
RENSSELAER
Edmeston
Cooperstown
Schoharie
ALBANY
Rensselaer
OTSEGO
Middleburgh
ALBANY
SCHOHARIE
Delhi
Bloomville
Cairo
COLUMBIA
DELAWARE
GREENE
Catskill
Hudson
Kaaterskill
Delaware
ULSTER
Kingston
DUTCHESS
CONN.
MASS.
VERMONT
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